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RESUSCITATION FROM ELECTRIC SHOCK.

We print as a supplement to this issue Dr. Goelet's instructions for resuscitation from apparent death from electric shock, which have been put in a form more practical than when they first appeared in our issue of Sept. 8 of last year as part of an article on the subject, and include some additions. The instructions as they now appear are, we believe, the most complete yet issued, and being from the pen of Dr. Goelet, they can be accepted as authoritative. We shall have a large number of extra copies of the poster printed, and will be glad to supply copies gratis to central and power stations, or for use wherever there is danger from electric shock.

ZINC IN BOILERS.

Elsewhere in this issue we print a paper read by Mr. W. D. Jameson at the Chicago meeting of the Northwestern Electrical Association, in which he considers the subject of feed waters and their treatment. We must confess that we cannot follow the author in his theory relating to galvanic action in boilers, as, for example, where he explains that "the very molecules of the iron in the boiler "plates and tubes are negative and positive to each other, but elec- "trolysis does not take place in the plate because the impurities, or, "we might say, foreign matter, such as silicon, oxygen and carbon "compounds, are not, and do not act as, conductors between these "negative and positive poles; the water in the natural condition, that "is, its chemical affinities and solvent properties being satisfied with "lime and other natural salts, will not act as a conductor between "these poles; consequently, having no conductor, the battery is not "connected by water, but when using distilled water, rain water, or "water with an excess of sodium salts, there is then a perfect con- "ductor, the water assuming the position of a battery and of a bat- "tery solution, connecting the negative and positive poles, and "inciting and generating a galvanic current. We then have a true "galvanic battery existing, due to the general makeup and influence "in the steam boiler. The purer the water or the greater the excess "of sodium salts, the stronger the galvanic current, the more pro- "nounced the electrolysis." As a remedy for the effects of the action of the galvanic current the author refers to the use of zinc, but says that the best method is to simply "satisfy the water with some "vegetable starch and saccharine matter, and in that way break up "the conductor between the negative and positive poles, whether "they be brass connections (negative) and the boiler plate and flues "(positive), or the molecules of the iron of the boiler plate." Leaving these theories to our readers to digest, we will add a few remarks on the subject of the use of zinc in boilers for the prevention of corrosion. When about a quarter of a century ago, surface condensers began to displace jet condensers in ships, startling effects of corrosion were noticed, in some cases the boilers being rendered unfit for use in the course of a few years or even less time. A commission consisting of a large number of scientists, representing many different branches of science, was appointed by the British government to investigate the cause of this corrosion, and two theories were advanced. One of these ascribed the corrosion to galvanic action and the other to the action of fatty acids derived from the oil carried into the boilers from the cylinders. It was recommended that in order to counteract these two effects, zinc should be suspended in the boilers, and only a pure mineral oil should be used in the cylinders of the engines. These remedies were very generally adopted, and after a few years the scare with respect to corrosion

subsided, and at the present time it is only in very rare cases that any abnormal corrosion is noticed in marine boilers. Owing to the fact that the two remedies were used simultaneously, no definite conclusions were arrived at as to which was the better, or whether each had a favorable effect. In the United States naval service, however, the records gave no conclusive evidence that the zinc played any important part in the prevention of corrosion, and we believe that at present marine engineering authorities consider that if pure mineral oil is used for lubrication in the cylinders, corrosion will be prevented without the use of zinc. While theoretically zinc should prevent corrosion from galvanic action, as practically applied it does not perform any such function. In the first place, it is practically impossible to maintain metallic contact between the zinc and boiler according to the usual methods of suspension. Even if the brace or other support to which the zinc is attached is carefully cleaned when the connection is made, in a very short time matter deposited from the water will destroy the electrical contact. Again, the electrical resistance of the circuit, consisting of the iron of the boiler and the electrolyte, is, with the impure water in boilers, undoubtedly very small, so that if electrical contact is maintained the zinc would be rapidly consumed. In point of fact, it has been observed that a few days after zinc has been placed in a marine boiler using sea water, the surface is covered with a deep non-metallic deposit, presumably a salt of sodium and zinc, and thereafter the metal is apparently used up in ordinary chemical, as distinguished from electrochemical, action. The verdict, as far as marine practice is concerned, is that there is no proof of the efficacy of zinc in the prevention of corrosion in boilers, which was, in early days, most probably due to the action of the fatty acids from vegetable and animal oils used in the engine cylinders. At the present time the use in condensing engine cylinders of any other than a pure mineral lubricant is strictly prohibited, we believe, in all of the navies of the world.

THE CONVENTION OF THE NORTHWESTERN ELECTRICAL ASSOCIATION.

The convention of the Northwestern Electrical Association at Chicago last week scored another success for this flourishing body, which now enters upon the fourth year of its existence. The proceedings were marked by the same lively spirit of interest which has characterized all of its meetings, the discussions being extended and generally limited to the matter at issue. The address of President Grimm was somewhat unusual in its tone, for, as a rule, when the subject of the relations of central stations with municipal bodies is broached in such an assemblage, the remarks consist of unqualified denunciations and personal abuse. In the earlier days of industrial electricity, many persons connected with its application seemed to feel that their intimate relations with the mysterious agent conferred upon them a superior quality, and this in some cases led to an arrogance of bearing which ultimately resulted in an unpopularity affecting their business interests; in two cases of which the writer is aware, the granting of rival franchises resulted directly from a personal unpopularity of this sort. From the conditions referred to above, the public in too many cases has been inclined to look upon the electric lighting interest as inimical to its welfare, the violent language so frequently indulged in being considered as an exhibition of arrogance unwarranted in one holding a public franchise. As a consequence, we think that President Grimm has performed a real service in calling attention to the other side of the case. In strongly advising that due recognition be given to the fact that electric lighting is a quasi-public business, and not a purely private enterprise, he goes to the fundamental principle, a proper observance of which would tend to greatly relieve the hostile feeling now too frequently existing, and thus obviate much financial loss. A proper regard for the sentiment of the community in which one lives is always desirable, and this should be observed, whether from principle or from mere policy. Among the papers read, that of Mr. George Cutter, on street lighting, seemed to excite the greatest interest. Though Mr. Cutter stated that he had purposely avoided the use of the words *arc* and *incandescent* in his paper, the arguments advanced imply the very general substitution of incandescent lamps for arcs in street lighting. A reservation is made as to the illumination of business streets, where the arc light may be advantageous in the evening, but after business hours should be cut out of circuit and an incandescent circuit cut in. In smaller towns and cities, and perhaps in the outlying districts of large cities, street illumination by incandescents has advantages which may lead to its more general adoption. In a recent Institute paper Mr. F. L. Pope favored this view, and spoke of the satisfaction of the public in a case where the change from arcs to incandescents had been made, and in the discussion of Mr. Cutter's paper it appeared that in a number of towns named where the latter method of illumination is used, the people are abundantly satisfied. There is a strong probability that in time the incandescent lamp will very considerably displace the arc for street illumination, and the paper of Mr. Cutter performed a timely service in bringing the matter before a body representative of the electric lighting interests. The paper of Mr. Abbott was received with considerable interest, doubtless, however, more on account of its expository character with respect to the electrical phenomena treated than for its conclusions. The numerous requests in the discussion for information as to various points touched upon, suggest that a lecture on the more involved subjects in electrical science having a connection with central station work would be a desirable feature for future meetings. While Mr. Abbott can speak with authority on electric traction, it is doubtful if his advocacy of the double-trolley system will meet with much support. As the telephone interests have accepted the situation, the only ground for a change to this system would be the evils resulting from electrolysis, and upon these we believe that the author laid too much stress, or rather, did not lay enough stress upon the fact that they can be kept within practical limits without serious difficulty. The papers of Messrs. McMynn and Stephens deal with practical subjects directly in line with the interests of central station men, and, therefore, were particularly appropriate for the occasion. The remarks of the latter on the points to be observed in the design of central stations differ from the usual opinions offered on questions of economy, in that the financial side of the subject is always kept well in view. While no one will question the desirability of having station buildings of the most substantial character, and machinery of the most economical type, the capital disposable is frequently limited, and if too much is expended on one part of the plant, another must suffer. The principle, therefore, of the proper proportioning of expenses on which Mr. Stephens lays stress, is an important one in many cases, while even with unlimited capital it does not follow that the most economical and expensive machinery should be bought. The best solution for any case is a matter for an engineer to decide, and it is gratifying to note that several speakers at the Chicago meeting strongly advised the employment of a competent engineer in laying down a plant, which indicates a change from the former belief that the engineering features would be sufficiently well taken care of by the sellers of the machinery. One of the conclusions in the paper on boilers read by Mr. McMynn will not, we believe, meet with much acceptance; we refer to his statement that the fire tubes of a boiler should not be considered as heating surface, but merely as passages for conducting away the products of combustion. We shall in another issue give some data on this point.

An Expensive Road.

The Niagara Falls & Lewiston Electric Railway, which runs at the foot of the gorge of the Niagara River, was formally opened last week. The seven miles of railway cost over a million dollars.

The Massachusetts Electric Lighting Association.

The sixth annual meeting of this association, held on Wednesday, July 17, at the Atlantic House, Nantasket Beach, was by far the most successful in the history of the body from a general standpoint, and particularly as regards attendance of members and delegates. Including a limited number of guests, 96 were present at the meeting and dinner. In fact, the meeting generally may be truthfully termed in every respect a diminutive representation of the National Electric Light Association gatherings.

The programme included a trip by boat to Nantasket, which was greatly enjoyed; a business meeting, which was called to order by President F. A. Gilbert at sharp noon; a ride over the new Nantasket Beach electric branch of the New York, New Haven & Hartford Railway Company, and an inspection of the new power station recently described in THE ELECTRICAL WORLD, by invitation of the railway company and the General Electric Company; and at 2.15 o'clock a dinner, such as only the host of the Atlantic House knows how to provide.

Relative to the business meeting it may be well to state that the principal object of the Massachusetts Electric Lighting Association, and really the foundation for its existence, is the protection of the electric lighting companies of the State from legislation adverse to their interests, and that its membership at present embraces about 75 per cent. of the capital employed in the business. It has already done good work through the untiring efforts of President Gilbert, Mr. Burdett and a competent executive committee, and the members of the association are always kept advised of what is being done, particularly during the session of the legislature, so that really at the annual business meetings very little else is done beyond the acceptance of the reports of officers and committees and election of officers for another year. The present meeting was not an exception to their general line of conduct. It lasted just an hour.

The report of the executive committees at this meeting was of more than usual interest After congratulating the companies in membership upon the favorable results accomplished during the year, it stated that a very large number of measures affecting the interests of gas and electric lighting companies had been introduced into the legislature. While, as a whole, they were more easily disposed of than in previous years, they included an unusually large number of propositions of a seriously detrimental nature, more or less disguised as to their true character, and for that reason all the more dangerous. For example, a bill to authorize the supply of electric current for heating and cooking purposes, if passed in its original form, would have permitted any person or corporation operating an electric power line to prosecute the business of electric lighting. An amendment was proposed to this same bill which, while harmless on the face of it, would, if passed, have jeopardized or destroyed the right of every company supplying any current for cooking, heating or power purposes to compel the purchase of its plant and property by the city or town in case of the establishment of a municipal plant. These were merely illustrations of numerous cases, emphasizing the necessity of "eternal vigilance" in the protection of vested interests. The most serious matters to dispose of were, as usual, attempted changes in the municipal ownership acts of 1891 and 1893. Eight bills were introduced upon this subject. Upon one of them particularly (the Legate Bill, so called, House No. 681,) there was a serious contest in the House. This resulted, however, in a most gratifying manner, the bill being defeated on a roll-call by a vote of 54 yeas to 123 nays, this being the first instance in which the members of the popular branch of the legislature have individually gone on record against legislation of this description. Practically the same bill passed the House in 1894 without a roll-call, and was defeated in the Senate. This result indicated a decided and gratifying sign of improvement in public and legislative sentiment. Indeed, upon all such matters, the legislature of 1895 was much in advance of its recent predecessors, dealing more justly with vested interests and yielding less readily to socialistic influence. It was not found necessary to call upon the individual members of the association for active work in connection with pending legislation except in one single instance and in that case the result was extremely gratifying. It is not the policy of the association to call upon individual members except in cases where it appears absolutely necessary. Upward of 60 various matters affecting the lighting interests had been introduced in the legislature at its last session, all of which had the attention of the counsel of the association. The report concluded with the numeration of important bills enacted and unenacted and with the belief that it indicated sufficiently the great importance of the work of the association to the lighting companies of Massachusetts, and clearly called for the continuance of that work until public and legislative sentiment has become sufficiently enlightened and conservative to deal with these matters intelligently and safely without the interference of the interests involved.

The executive committee also recommended amendments to the by-laws providing for the admission of purely gas companies to membership in the association, and changing the name to the Massachusetts Electric & Gas Association, which were unanimously adopted. This action was taken after serious consideration and upon the recognition of the strong mutuality existing between the two interests from the legislative standpoint. The election of officers resulted as follows: President, F. A. Gilbert, Boston Electric Light Company; vice-presidents, Hon. T. C. Bates, Worcester Electric Light Company, and C. L. Edgar, Edison Illuminating Company, Boston; executive committee, the above officers and Col. C. C. Fry, Lynn Gas & Electric Company; F. L. Richardson, North Adams Gas Company; J. T. Almy, Salem Electric Light Company; H. F. Coggeshall, Fitchburg Gas Company, and George R. Stetson, New Bedford Gas and Edison Light Companies. Hon. Everett W. Burdett is continued as general counsel and secretary, and Mr. B. W. Cutter, of the Boston Electric Company, is continued as clerk.

The dinner was a success in every respect, and the presence of an orchestra occasioned the singing of many of the lively songs of the day. Toasts were offered from time to time to President Gilbert, Hon. E. W. Burdett, Col. Hefft, the General Electric Company, Fort Wayne Electric Company and Mr. E. I. Garfield, its New England manager, who furnished the wine for the occasion. Hon. Jno R. Murphy, Commissioner of Wires of Boston, was present as a guest, and made a speech touching the underground question, after which the meeting adjourned.

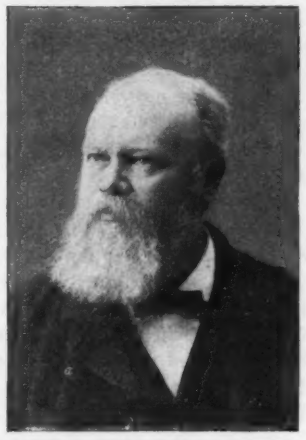
Contributors to the "Invention of the Electromagnetic Telegraph" Series.

Mr. Francis W. Jones, electrical engineer of the Postal Telegraph Company, whose article we conclude in this week's issue, though born in Nova Scotia, is of Puritan ancestry, being a descendant of Lewis Jones, who settled at Roxbury, Mass., in 1640. At the age of 13 while employed as a postoffice clerk, Mr. Jones learned telegraphy and after three months added telegraphic work to his other postal duties, which included the issue of marriage licenses and the recording of vital statistics. At the age of 21 he removed to St. John, N. B., to accept a position as operator in the repeater station for the Atlantic cables, and it was at his suggestion that difficulties from earth currents were here avoided by the employment of the metallic circuit. While living in St. John, Mr. Jones gave probably the first public exhibition of the electric light on this continent. In 1870 from a battery of 200 bi-chromate of potash cells in series, he exhibited the arc light from the window of the telegraph office upon the occasion of a visit of royalty to the city. In 1872 Mr. Jones accepted the position of chief operator on the night staff of the Western Union Telegraph Company in Chicago, and was rapidly promoted successively to Sunday manager, assistant chief operator, assistant to the electrician and assistant manager of the Chicago office. It was while in Chicago that, in 1874, he set up the first Edison quadruplex system west of New York, and in 1875 greatly improved the system by changing it from the bridge to the differential form and applying condensers to mitigate the "kick." In 1880 he became general circuit manager of the Western Union Telegraph Company at New York, and two years later was vice-president and general manager of the Union Electric Manufacturing Company, which position he resigned in 1884, to accept that of electrician of the Banker's & Merchant's Telegraph Company. In 1885 he was appointed general manager to the receiver of the latter company, and later on became assistant general manager and electrician of the joint United Lines and Postal Telegraph Company.

Mr. Jones has obtained a number of patents on various telegraphic and telephonic devices, among the most important of which are several on modifications of the quadruplex system and on a duplex system of telegraphy. He was largely instrumental in the

formation of the Chicago Electrical Society and of the American Electrical Society, and has always been devoted to the interests of the Telegraphers' Mutual Benefit Association. He is a life member of the New York Press Club and of the American Institute of Electrical Engineers and was first president of the New York Electrical Society. In February, 1890, he was expert of the New York Senate Committee during its investigation into the methods employed in the public supply of electricity. Mr. Jones has decided modern views on all matters relating to telegraphy, and recently has been instrumental in supplanting about 100,000 cells of primary battery at the principal stations of the Postal Company with dynamos and dynamotors, arranged in connection with greatly improved apparatus and devices for which he has received a large number of patents.

FRANCIS W. JONES.



FRANKLIN L. POPE.

Franklin Leonard Pope, the first portion of whose article will appear in our next issue, was born in the village of Great Barrington, Mass., Dec. 2, 1840. He received the customary common school education in his native town and supplemented this with a year's study at the academy in Amherst, Mass. His youthful amusements and boyish occupations early indicated the direction in which his life work would naturally tend, as a boy having shown great aptitude for scientific and mechanical pursuits. The first money he earned was by selling water color drawings which he made of the locomotives on the Housatonic Railway.

In 1857 Mr. Pope was appointed operator at Great Barrington in charge of the office of the American Telegraph Company, having for the purpose received instruction in the operation of the Hughes printer. From this position he was transferred to Springfield, Mass., as circuit manager in charge of the line between there and Albany. Early in 1860 he went to New York and was engaged on the *Scientific American* as an artist and writer until after the outbreak of the civil war, when he again entered the telegraph service as operator at Providence. He became at this time an expert Morse operator and his unusual ability attracted the attention of Gen. Marshall Lefferts, the engineer-in-chief of the American Telegraph Company, who soon transferred Mr. Pope to a more prominent position in the New York office, where he was engaged in the preparation of a series of maps of the whole system of telegraph lines owned by the company.

During the draft riots in New York Mr. Pope met with many exciting adventures in his successful attempt to restore communication between New York and Boston, the lines in the city having been cut by the rioters. In 1864 he accepted the appointment as assistant engineer of the Russo-American telegraph, a projected line from Washington Territory to Siberia via Behring Straits, which was partly finished but abandoned three years later. In this capacity he made an exploration and survey of the southern portion of Alaska in the watershed of the Stiskeen River, going overland in the winter with sledges and dogs from Lake Tatla, B. C. After his return from Alaska, Mr. Pope for some time edited the *Telegrapher*, and also wrote his well-known work, "The Modern Practice of the Electric Telegraph," which has ever since its publication been recognized as the standard authority on that subject. For the decade following his return to New York, he devoted himself to inventions, and in that time organized the gold and stock reporting system using the Laws instrument, originated private line printing telegraphy and invented a thoroughly practicable system of electric signals for steam railways, which has since been developed by the Union Switch & Signal Company. Mr. Pope was, in 1885, placed in charge of the patent interests of the Gold & Stock Telegraph Company, but soon accepted a similar position with the Western Union Telegraph Company, in which he remained until 1881, when he engaged in private practice as a patent solicitor and expert. In 1884 he assumed editorial charge of the monthly *Electrician*, the title of which was then changed to the *Electrician and Electrical Engineer*. Mr. Pope was a charter member of the American Institute of Electrical Engineers, and in 1886 was elected its second president. Throughout his active career, Mr. Pope has given much attention to various historical investigations, and the very thorough manner in which he has brought to light the early work of Davenport, House and other inventors, has led to the general recognition of the real merit of their labors in the electrical field.

J. J. Fahie, who will contribute the article written from the English standpoint, was born in Tipperary, Ireland, in 1846, and finished his education at the Catholic University of Ireland, where in 1863 he obtained honors and a mathematical prize. In 1865 he began his connection with the telegraph, and in 1867 joined the Indo-European Telegraph department. At present he is connected with the Persian Gulf Cable Company, and resides at Karachi, India. Mr. Fahie is the author of a history of "Electric Telegraphy to the Year 1837," a standard authority on the history of the early telegraph. This valuable work, unlike several other telegraphic historical treatises, is largely based upon original material and led to a revision of many of the prevailing ideas as to the genesis of the telegraph and priority in the discovery of some of the electrical principles involved. Mr. Fahie was one of the first European writers of note to recognize the important part played by Henry in the invention of the telegraph, and it was he who rescued the early work of Edward Davey from obscurity and showed him to be one of the most advanced of the early inventors in this branch. Mr. Fahie is also the author of some standard electrical testing methods and of a number of papers on scientific and other subjects connected with the telegraph and telephone. In 1874 he offered to the present English Institution of Electrical Engineers the sum of 100 pounds to form a fund, the proceeds of which, under the name of the "Fahie Premium," are awarded to authors of papers making valuable contributions to electrical science.

J. J. FAHIE.

Rudolf Petsch, whose article is written from the German standpoint, is at present Postrath (Postal Councillor) in the telegraphic division of the central office of the Imperial Postal Service, Berlin. He was born in 1851, and at the conclusion of his studies at the Gymnasium, he entered the army in 1869 to serve his one year's military service. He took part in the war of 1870-71 against France, during which he was severely wounded before Le Mons. On Jan. 1, 1872, after being completely restored to health, he entered the Imperial Telegraphic service. During 1889 he was editor of the *Elektrotechnische Zeitschrift* (the organ of the Elektrotechnische Verein, Berlin), having previously written for that journal several years. Herr Petsch was decorated with the Iron Cross for bravery in battle during the Franco-Prussian War.

RUDOLF PETSCH

Mr. A. M. Tanner, the contributor of the French article, is an American by birth, but has resided in France for a number of years engaged in special researches with reference to inventions and patents. Mr. Tanner has made many important discoveries as to the birth of early inventions and has been pronounced by Prof. Hospitalier to have a special scent for forgotten inventions and inventors While in America he was connected with the *Scientific American* for a number of years, and has since been a frequent contributor to European and American scientific journals, a number of articles from his pen having appeared in the columns of THE ELECTRICAL WORLD.

CHICAGO CONVENTION OF THE NORTHWESTERN ELECTRICAL ASSOCIATION

THE Chicago meeting of the Northwestern Electrical Association added another to the successes of this vigorous body, and again demonstrated its capacity for usefulness. The best criterion by which to judge of the success of the sessions of a professional body is the interest manifested through the discussions of papers, and in this respect the Chicago meeting takes high rank. Owing to the homogeneous character of the association and the personal acquaintance existing among its members, the proceedings had an informal nature favorable to the exchange of ideas on the floor, the speakers not being deterred from expressing their opinions as they might have been if addressing an audience largely unknown to them. Another advantage which the association possesses is the identity of interests through the active membership being confined to a territory in which the conditions encountered are practically the same. As a consequence, the experience of one has a direct and positive value to the others, and any movement inaugurated is assured of general support.

One of the amusing incidents of the meeting was the request for financial support by an inventor for a method to "fertilize the soil by electricity," which method the said inventor claimed to have originated in Northern Prussia 32 years ago. As an instance of the loose statements continually made with a view to injuring the business of those engaged in the public supply of electricity, one of the members related a characteristic occurrence. While before the City Council of a town to which he supplied street illumination, the length of the arms supporting the street incandescents was criticised, one of the councilmen stating that they were 14 feet long in a neighboring town. The electric light man, to settle the question, proposed that a visit be made to the town referred to, he to pay all expenses if the statement were true, and the Council to foot the bill if the opposite were the case. The proposition was accepted, a committee of the Council visited the town, and it was found that the arms were a foot and a half long. Then one of the councilmen thought that a mistake had been made as to the name of the town, but as the party started to visit the other place suggested, the manager of the plant was met, who informed them that arcs, not incandescents, were used there. One of the councilmen then remembered that a drummer had told him that arms such as those in question were used in a certain town, and upon a resident being telephoned to it was answered that the arms in use were nine feet long. A train was then taken for this place, and upon arrival there it was found that the arms were a foot long.

The many commercial exhibits were much appreciated by the members. This feature has become to be considered one of much value, permitting, as it does, the examination of the latest advances in material and apparatus, and leading to the exchange of ideas between members as to the desirability of their adoption.

JULY WEDNESDAY 17"

The third semi-annual convention of the Northwestern Electrical Association was called to order at 10.30 a. m. in the ladies' ordinary of the Leland Hotel, by Mr. George Grimm, first vice-president and acting president since the death of the late president, Hon. H. C. Thom. More than 40 members responded to their names, and many others came in before the close of the session. After roll-call the acting president opened the proceedings by delivering an address.

Mr. Grimm, in the opening paragraphs of his address, referred to the great loss of the association in the death of its late president, Mr. Henry C. Thom, and paid a feeling tribute to his memory. He recalled the geniality of his character, the warmth of his friendship, the sturdiness of his manhood, and concluded by paying the tribute which all strive to merit, but few succeed—that the world is better for his having lived in it.

Mr. Grimm endorsed the passage in the presidential address delivered at the annual meeting by Mr. Paige, in which the warfare constantly being waged against electric lighting interests was referred to, but added that we may take it as an indispensable truth, that no evil, no sentiment destructive of or foreign to common fairness, can live and grow under a government based upon and deriving its power from the consent of the governed, without the existence of a like evil to give it nourishment. If, therefore, we see an evil growing in the community that works injustice or injury, we should find the cause which has dulled the sense of justice in the people and permits the evil to exist. In the present case, he states that the cause may be found in the manner in which many corporations take advantage of the valuable franchises granted to them as gifts, bestowing no thought upon the obligations which their possession involves, and conducting their business with no other object in view than the profits to be made. Every effort is directed to the earning capacity, frequently for the purpose of forcing, by its dividend paying qualities, a stock, originally watered, up to par. Every concession requested by the community that gave it the possibility of existence is resisted until the patience of the public is exhausted and sentiment becomes inimical to an industry that should have received united support and commendation. This sentiment of dislike and clamor for municipal ownership of the quasi-public industries like electric lighting, gas works, water works and the like, is the natural outgrowth of either unduly large profits extorted by the line of policy above referred to, or by lack, on part of the managers, of proper regard for the rights of the people.

The root of this evil was pronounced to be that some of these corpo rations seem unable to realize that their business is not strictly private but semi-public in its character, and should be managed accordingly. The public never stops to discriminate in passing judgment between those who are and who are not mindful of its rights and wishes, and the result is that the general sentiment becomes hostile to all alike and ready to accept any plan of relief or retaliation which may be suggested even as against industries which are not at fault, and which would innocently suffer. Thus, the agitator and pot-house politician find ready soil to receive their seeds of communistic doctrine, and willing ear for the abuse of others and opportunity for self-glorification.

To this subject Mr. Grimm invited the consideration of the members of the association, both as individuals and as a body, being dependent upon the public good-will, a contest is destructive to their interests, and all should use their influence in every possible direction to gain and hold this good-will. The business, he stated to be hazardous at best, and cannot afford to bear additional risks, such as public ill-will would bring.

At the conclusion of the address Mr. Bunce moved that a committee be appointed to present suitable resolutions on the death of the late president, and letters from Mrs. Thom were read thanking the association for the beautiful floral tributes placed on the grave of her husband, and for other tributes of respect and esteem.

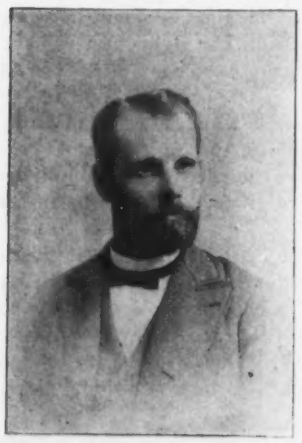
Mr. J. S. Stephens then read his paper on "Central Station Economics." In planning a central station Mr. Stephens advised the employment of a thoroughly competent engineer, and that thorough consideration should be given to the matter of its location relative to centre of distribution, proximity to water and full supply, cost of property, future combinations of light and power supply and use of exhaust steam for heating. In southern latitude an

ice and refrigerating plant may be added, and other combinations are possible. Fireproof construction is advised, but the expenditures for permanent investments should not be so large as to make it necessary to purchase cheap machinery in order to keep within the limits of capital disposable. As to machinery, a simplicity of detail, proportion of parts and permanency of construction that will give continuous, reliable service, is pre-eminently necessary to obtain satisfactory results. Unless the cost of coal is less than $1 per ton, compound engines will usually be cheaper than simple engines. Makers' guarantees are pronounced useless unless some prearranged plan be provided to determine their fulfillment, and better still, some penalty and premium proportional to the value of difference in economy.

Mr. Stephens believes that the relative efficiency of the different designs of electrical machinery and adaptability to any particular service, is mainly a question of local conditions. The varying range of efficiency as compared with the steam power end of the plant is small, and while the direct-connected dynamo and engine will always make the best mechanical construction, Mr. Stephens is not convinced that the saving due to this method of driving will always pay interest on the actual difference in cost. As to employees, he states that really good men cannot be retained unless a fair salary is paid, the amount of which an efficient man can save if given fair opportunities. He advises that employees be not treated as machines, as the interests are too varied for this to prove successful, but responsibility be placed upon them and a premium plan of operation put into force that will actually give the men an interest in the business and at the same time tend greatly to the employers' benefit in the economical operation of a station.

A thorough, systematic method of records of service, including boilers, engines, dynamos and circuit losses, with properly tabulated monthly deductions or averages, along with a suitably classified system of accounts are recommended. On the mechanical or operating side, such records of fuel, steam pressure, horse-power, electrical output of stations and current furnished to consumers, would be simply and easily kept, and properly tabulated would be of great value, and it was suggested that the association take up this matter. With a record for one year of these items alone, from the stations represented, Mr. Stephens believes that the data so obtained would certainly be of great value to the association and to the different central stations, by providing a reliable working basis for improvements tending to the more economical production of electric light and power.

The discussion on Mr. Stephens' paper was very lengthy, those who participated being Messrs. Norcross, Abbott, Shattuck, Korst, Grimm, Markle, Caspar, Copeland and Gregory. The main subject of discussion related to the size of units in central stations, and the consensus of opinion was that there should be such a division that the load factor of the machines running during lighter loads should be high, or in other words that the larger units used during the hours of heavy lighting should not be used during the hours of light loads. Mr. Stephens advised the use of boilers that would enable a pressure higher than normal to be carried when abnormal demands for lighting were made, as on the Fourth of July and during Christmas time. Mr. Abbott condemned the use of compound engines where the load factor is small, and cited the case where 40 per cent. of the steam supplied to a compound engine was used in pumping against the atmosphere, the pressure in the low-pressure cylinder at exhaust being below that of the atmosphere. Mr. Stephens considered that the compound engine is more economical than the single engine within a wide range of load, though not so on extremely light loads. Mr. Copeland gave his experience in central station work, and advised that any one starting in to build a plant, should look into the future and at the start provide for prospective increases of demand; he believes in a number of units proportioned to various periods of lighting and plenty of boiler capacity, and that a station owner can better afford to put in duplicate machinery to provide for breakdowns, than to run the chances of dissatisfaction of customers in such an event, with consequent loss of custom. Mr. Gregory advised those contemplating the building of a station to obtain the service of a competent electrical engineer and thus save the great expense that may follow through errors in design. Mr. Abbott referred to a case where a compound engine was installed in a new plant whose smaller cylinder was arranged to be operated as a single condensing engine, and then, as the load increased, the other cylinder thrown in, the engine then operating compound, the results being described as very satisfactory.



J. S. Stephens.

Mr. A. V. Abbott next read his paper on "Electrical Interference" in which the conditions giving rise to the interference of various electrical circuits on each other are considered and remedies for the resulting evils suggested. The subject is considered under the heads of leakage, electromagnetic induction, electrostatic induction, common path interference and electrolytic action. In regard to leakage, it is stated that by proper design and appropriate construction and the adoption of an efficient standard of electrical maintenance, all electric circuits may, at least in a commercial sense, be perfectly protected and all damage from leakage avoided. The simplest and the surest relief from electromagnetic disturbance is to separate the interfering circuits by such a distance as will render the induction effect negligible. Otherwise the geometrical positions of the conductors should be frequently transposed, either by twisting them together as in a cable, by placing them successively on different pins in pole iron work, the circuit injuriously affected being the one with which these latter expedients are usually adopted. The same results are obtained by the use of concentric conductors. In telephony the difficulty is eliminated by opening the disturbed circuit, either by condensor or by an inductance of such dimensions as will choke out the objectionable impulses while permitting the desirable ones to pass. Interference in electrostatic induction is so rare and usually of so small an amount as to be perceptible only in telephonic circuits. As to electric railway ground returns, a complete metallic circuit is recommended, with the statement that it would annually save in coal more than the cost of the extra capital required in line construction. Electrolytic action in ground returns is considered at length in the concluding portion of the paper, and two methods of remedy are proposed. The adoption of the double-trolley system and Mr. Farnham's method of the careful location of electropositive points in the territory affected and then the attachment to water pipes, cables and other metallic structures therein, of return conductors of such dimensions as to be fully capable of receiving all current which otherwise would tend to leave the metallic pipes, etc., at the electropositive points. Mr. Abbott considers the advantages and disadvantages of the double-trolley system, and concludes that since now electrolytic action has arisen to a point of extreme importance and railway companies are very likely to be deprived from extending their lines, or only permitted to lay them under the penalty of the payment of heavy damages for injury to underground metallic structures, there is no doubt but that sufficient mechanical inventive skill will be quickly found to place the double trolley upon a perfectly successful and commercial basis.

A. V. Abbott.

Part was taken in the discussion of Mr. Abbott's paper by Messrs. Ball, Cutter and De Land. Mr. Cutter ridiculed the adoption of the double-trolley system in order that telephone wires may be kept free from trouble, and dwelt upon the fact that induction from an alternating circuit meant loss of power in that circuit, which furnished reason for its avoidance wherever possible. Mr. De Land expressed himself in sympathy with Abbott's advocacy of the double-trolley system. Mr. Abbott, in closing the discussion, said that to cure the evils of underground electrolytic action, an overhead double-trolley system was not necessarily implied, as it may be a conduit system with two conductors.

After the discussion on Mr. Abbott's paper, the author, upon motion of Mr. De Land, was elected an honorary member of the association. The meeting was then declared adjourned until 9 a. m. Thursday morning.

Supplement to THE ELECTRICAL WORLD, July 27, 1895.

PRACTICAL SUGGESTIONS FOR RESUSC
FROM ACCIDENTAL EL

By AUGUSTIN H. G

THE urgent necessity for prompt and persistent efforts at resuscitation of victims of accidental shocks by electricity is very well emphasized by the successful results in the few instances recorded. In order that the task may not be undertaken in a half-hearted manner, it must be appreciated that accidental shocks seldom result in absolute death unless the victim is left unaided for too long a time, or efforts at resuscitation are suspended too early.

In the majority of instances the shock is only sufficient to suspend animation temporarily, owing to the momentary and imperfect contact of the conductors, and also on account of the indifferent parts of the body submitted to the influence of the current. It must be appreciated also that the body under the conditions of accidental shocks seldom receives the full force of the current in the circuit, but only a shunt current, which may represent a very insignificant part of it.

When an accident of this nature occurs, the following rules should be promptly adopted and executed with due care and deliberation:

1.—Remove the body at once from the circuit by breaking contact with the conductors. This may be accomplished by using a dry stick of wood, which is a non-conductor, to roll the body over to one side, or to brush aside a wire, if that is conveying the current. When a stick is not at hand, any dry piece of clothing may be utilized to protect the hand in seizing the body of the victim, unless rubber gloves are convenient. If the body is in contact with the earth, the coat-tails of the victim, or any loose or detached piece of clothing, may be seized with impunity to draw it away from the conductor. When this has been accomplished, observe Rule 2.

2.—Turn the body upon the back, loosen the collar and clothing about the neck, roll up a coat and place it under the shoulders, so as to throw the head back, and then make efforts to establish artificial respiration (in other words, make him breathe), just as would be done in case of drowning. To accomplish this, kneel at the subject's head, facing him as shown in Fig. 1, and seizing both arms draw them forcibly to their full length over the head, so as to bring them almost together above it, and hold them there for two or three seconds only. (This is to expand the chest and favor the entrance of air into the lungs). Then carry the arms down to the sides and

FIG. 1. FIRST POS

FIG. 2. SECOND PO

ESUSCITATION FROM APPARENT DEATH
TAL ELECTRIC SHOCKS.

TIN H. GOELET, M.D.

1. First Position.

2. Second Position.

front of the chest, firmly compressing the chest walls, and expel the air from the lungs, as shown in Fig. 2. Repeat this manœuvre at least sixteen times per minute. These efforts should be continued unremittingly for at least an hour, or until natural respiration is established.

3.—At the same time that this is being done, someone should grasp the tongue of the subject with a handkerchief or piece of cloth to prevent it slipping, and draw it forcibly out when the arms are extended above the head, and allow it to recede when the chest is compressed This manœuvre should likewise be repeated at least sixteen times per minute. This serves the double purpose of freeing the throat so as to permit air to enter the lungs, and also by exciting a reflex irritation from forcible contact of the under part of the tongue against the lower teeth, frequently stimulates an involuntary effort at respiration. If the teeth are clenched and the mouth cannot be opened readily to secure the tongue, force it open with a stick, a piece of wood, or the handle of a pocket knife.

While this is being done, a physician should be summoned, who, upon his arrival, can best put into practice Rules 4 and 5 in addition to the foregoing, should it be necessary.

4.—Forcible stretching of the sphincter muscle controlling the lower bowel excites powerful reflex irritation and stimulates a gasp (inspiration), frequently when other measures have failed. For this purpose, the subject should be turned on the side, the middle and index fingers inserted into the rectum, and the muscle suddenly and forcibly drawn backwards towards the spine. Or, if it is desirable to continue efforts at artificial respiration at the same time, the knees should be drawn up and the thumb inserted for the same purpose, the subject meanwhile retaining the position on the back.

5.—Oxygen gas, which may be readily obtained at a drug store, if the accident occurs in a city or large town, is a powerful stimulant to the heart if it can be made to enter the lungs. A cone may be improvised from a piece of stiff paper and attached to the tube leading from the tank and placed over the mouth and nose while the gas is turned on during the efforts at artificial respiration.

It is both useless and unwise to attempt to administer stimulants to the victim in the usual manner by pouring it down his throat, therefore this should not be attempted.

AFTERNOON AND EVENING.

During the afternoon the delegates and their friends marched in a body to the down-town station of the Metropolitan elevated electric railway and enjoyed a ride over the line, after which they visited the power house. Later in the day many of the delegates visited the larger plants of the Chicago Edison Company.

In the evening the members divided into several parties, some visiting the parks and other going to the theatre.

JULY THURSDAY 18TH

Although 9 o'clock was the hour set for calling the meeting to order, it was a few moments past ten when Acting-President Grimm opened the proceedings by calling for the report of the committee on legislation. Mr. Lord read the report of the committee on legislation, whose contents indicated how necessary organized and watchful care is to prevent legislation of an obnoxious and destructive character from creeping in. This report was fully discussed by Mr. Schuette, Mr. Norcross and others, and finally laid over till the next meeting. Mr. W. D. Jameson then read his paper on "Boiler Feed Waters: Their Treatment," which appears in another column.

Upon the conclusion of Mr. Jameson's paper, and after the transaction of some business, Mr. Grimm, on behalf of the association, thanked the commercial houses who advertise in the report of the association, thereby largely helping to pay the expense of its publication. Mr. George Cutter next read his paper on "Electric Street Lighting."

Mr. Cutter in his paper offers an argument for a uniform street illumination of mild intensity, instead of the use of arc lights, which give brilliant effects and really poor practical illumination, and whose glare blinds a person for half a block with accompanying inability to see for the next half block. While this mild illumination may be best for the outlying or residence districts during all hours of the night, it is not sufficient for the business centre during the earlier hours of the evening, and it is, therefore, proposed that a brilliant illumination in the latter locality shall be maintained until bedtime and then changed to the illumination of the same mild intensity that serves for the residence districts earlier in the evening.

GEORGE CUTTER.

Those taking part in the discussion of Mr. Cutter's paper were Messrs. Schuette, Thorp, Harding, Grover, Gunderson, Mercein, Norcross, Summers, Wiley, Korst and Goltz, and consisted principally in the opinions of the various members as to the relative merits of arc and incandescent street lighting, those supplying arc lights as a rule favoring that form of illumination, and those supplying incandescents for street lighting considering that system to be the best. From the discussion it appeared that where the latter system was used it gave entire satisfaction to the public. There was some discussion in regard to the method of putting up street incandescents, some of the members being in favor of having the fixture on the pavement side of the pole instead of the street side. As to brilliant illumination in business portions of towns, there was a difference of opinion, one speaker stating that the merchants in his town did not want any light at all in the early evening, the light from the store furnishing sufficient illumination, while others thought arc lights necessary in the business streets. One of the speakers who supplied arc lights in his city where the lamps are two blocks apart, said that the results were very unsatisfactory and that he believed incandescent street lighting would eventually supersede arcs everywhere, unless arc lamps of small candle power could be made. A number of the speakers expressed the opinion that street incandescents should not be higher than seven and a half to nine feet above the ground. An instance was related where upon a renewal of a city contract 1,200 candle power lamps were specified instead of lamps of 2,000 candle power used previously; for a considerable period, however, owing to lack of sufficient 1,200-cp dynamos, 2,000 candle power lamps were continued in a certain portion of the city, but the citizens never noticed the difference between them and the lower candle power lamps, and the manager of the station himself had to observe very closely in order to see any difference in the illumination. Mr. Copeland made a motion, which was adopted, to the effect that the secretary of the association collect data from its members as to the number of incandescent and arc lights the various companies have in use, the capital invested and any other information that may be considered of value to the association. Mr. Thorp mentioned the desirability of a device which would automatically cut out transformers when no lights were being served from them, and one of the audience stated that an inventor of Hyde Park, Chicago, was then in Washington making application for a patent on such a device. Upon the conclusion of the discussion on Mr. Cutter's paper, which lasted until after 12 o'clock, the meeting was adjourned until 9 a. m. Friday.

W. D. JAMESON.

AFTERNOON AND EVENING.

A special train having been chartered from the Santa Fé Road, the members were given ample opportunity to inspect the greatest engineering undertaking of to-day, the drainage canal, which, when completed, is expected to cleanse the foul Chicago River. Several stops were made to inspect the various methods of removing rock, clay or glacial drift.

Some of the members also visited the Auditorium lighting plant, the telephone plant, and enjoyed a ride through the parks in Columbia coaches, after which a lunch was served by Mr. George C. Bailey, of the John A. Roebling's Sons' Company.

In the evening the entertainment committee marshalled the guests to the Columbia Theatre, where they thoroughly enjoyed "The Merry World," many "gags" being directed at the delegates.

JULY FRIDAY 19TH

The final session of the meeting was opened at 10 a. m., when President Grimm read telegrams from well-known members expressing regret at being detained at home by business affairs, and a number of other communications. The delinquencies of members in neglecting to remit dues to the treasurer was commented on, and the secretary instructed to draw on each delinquent member for the full amount due, and to accompany the draft with a letter of explanation. Twelve applications for membership were received and favorably acted upon.

Mr. John C. McMynn then read his paper on "Boilers and Suggestions for Boiler Specifications." He stated that he personally preferred the old horizontal tubular boiler, and while admitting fully the advantages of water tube boilers, he believed that the former will remain in use for many years, especially in plants where there is a large increase of power for short intervals, it being fitted for this purpose on account of the large amount of energy stored in the hot water contained.

JOHN C. MCMYNN.

Punched rivet holes are not favored, and it is advised that rivets should always, where practicable, be driven by hydraulic pressure. Mr. McMynn favors the hanging horizontal of tubular boilers on "I" beams supported independently from the walls. He prefers to have longitudinal seams where they are accessible for inspection and, therefore, exposed to the flame, rather than hidden in

brick work, where they cannot be easily examined. The main portion of the paper consists of specifications for a 72-inch horizontal tubular boiler, but the various dimensions are also given for 40, 50 and 60 inch boilers. Mr. McMynn recommends the following form of guarantee; that the maker shall guarantee the cost of evaporating 1,000 pounds of water from and at 212 degrees ,using whatever coal in his opinion is the most economical, and to name such coal in his proposition, the owner reserving the right to purchase the fuel in the open market. The cost of evaporating 1,000 pounds of water from and at 212 degrees, should then not be more than seven and a half cents when the cost of coal is $1, and 10, 12½, 15, 17½ and 22 cents respectively, when the cost of coal is $1.50, $2, $2.50, $3 and $3.50.

The discussion on Mr. McMynn's paper was participated in by Messrs. Stephens, Grimm and Patnall. In answer to a question in what part of the boiler Mr. McMynn would use the large-sized sheet which he advocated, the latter stated that he would place it at the front end of the boiler, in order to get it away from the fire box. Mr. McMynn, replying to a criticism in regard to having the longitudinal seam of a horizontal boiler in such a position as to be subject to flame, said that he thinks it better to heat the seam and keep it hot, and also to permit it to cool gradually, as in all the boilers of this kind that he knows of there have been no leaks, while the reverse is the case with boilers in which the seam is out of contact with the fire. Mr. Stephens believed that it would be better to have the seam on the top and use asbestos covering, which can be easily removed to make the seam accessible. Mr. McMynn stated that he did not believe that the tubes should be counted as efficient heat surface, but merely as a means for carrying out the produce of combustion, but Mr. Patnall did not agree with this theory.

Mr. Mercein was requested by the president to read, in the absence of the author, the paper prepared by Prof. D. C. Jackson on "(1) The Choice of Transformers, (2) The Advantage To Be Derived by Testing Every Transformer before Placnig It on the Line." For some reason not announced, the paper was not given out for publication.

The changes in officials and committees were next announced: First Vice-President George Grimm was elected to the presidency, to succeed Henry C. Thom; Second Vice-President Pliny Norcross was elected first vice-president, and P. H. Korst, of Racine, was elected second vice-president. As the next meeting will be held in Milwaukee, in January, 1896, Messrs. Andrea, Rau and Smith, of that city, were appointed an entertainment committee, and a transportation committee was named, consisting of Mr. Mercein, and the president and secretary. A committee to secure papers to be presented at the next meeting and awaken an interest in a topical discussion was appointed, consisting of Fred De Land, J. S. Stephens and W. H. Thorp, together with the president and secretary. After transacting some further business, and acknowledging the receipt of an invitation to the members to visit the Chicago telephone exchange, the meeting adjourned.

CONVENTION NOTES.

Mr. Will Low, of the Electric Appliance Company, was in his usual happy condition.

Mr. F. S. Terry was looking after the interests of his clients in a very thorough manner.

The presence of Mr. S. F. B. Morse guaranteed that the merit of Kerite insulation would not be overlooked.

"We are in the electrical supply business to stay" is what the Chicago General Fixture Company had to say.

John Valentine, of the Valentine-Clark Company, was on hand to talk about poles and ties to his out-of-town friends.

The Sioux City Brass Works distributed attractive cards and circulars describing the Wilson dynamos and motors.

Mr. J. H. Reid, one of the pioneers in the electrical supply business, represented the Westinghouse glass factory.

Mr. George Cutter, and his chief of staff, Mr. Albert Scheible, were loaded for bear on the subject of Cutter's specialties.

The Sioux City Electrical Supply Company, of Sioux City, Iowa, was well represented and distributed some attractive circulars.

The "Allen Soldering Stick," so popular with workmen, was exhibited by Messrs. L. B. Allen, the inventor, and R. S. McMillan.

The Lane & Bodley Company, of Cincinnati, O., gave to each member an instructive work on Corliss engines, containing tables of value.

Mr. C. L. Burlingham represented the McDermid Manufacturing Company of Chicago, and secured some profitable business for his company.

The Western Electric Company made a handsome exhibit and extended a cordial invitation to all to visit their immense works on the west side.

The Charles E. Gregory Company, of Chicago, presented to each delegate a convenient pocket telephone directory of the electrical and allied interests.

The Heine Safety Boiler Company, of St. Louis, had its Chicago manager, Mr. James H. Harris, on the ground swapping yarns about "the old days."

The Royal Electric Company of Peoria, manufacturers of the famous Royal Alternator, was well represented by Messrs. G. G. Luthy and Frank Thone.

Mr. Charles G. Burton, representing the Central Electric Company, looked specially after the interests of Okonite wires and cables and interior conduit.

Mr. H. Stillson Hart, of the Crouse-Tremaine Carbon Company, of Fostoria, Ohio, was on hand to represent the merits of his cored carbons for series arc lamps.

Col. George S. Searing, 1644 Monadnock Building, formed the acquaintance of every one who could be at all interested in any of the many specialties he handles.

Mr. George C. Bailey, western manager of the John A. Roebling's Sons' Company, extended an invitation to all to join his luncheon party, which was a decided success.

The Simplex Electrical Company's interests were well cared for by Mr. H. R. Hixson, who lost no opportunity to impress the merits of Simplex insulation on every delegate.

The Western Electrical Instrument Company of Newark, N. J., was represented by an exhibition of instruments on switchboards, and also by attractive and serviceable pamphlets.

Messrs. S. F. B. Morse & Company, 1014 Marquette Building, also distributed copies of a lamp-series method of measuring high electrical pressure with a low reading voltmeter.

C. E. Woodruff & Company, 235 Lake Street, Chicago, were well represented by Mr. F. D. Mack, who did full justice to American circular loom goods and other specialties handled by his house.

The Mason Electric Equipment Company, Chicago, made an attractive display of Medbery insulating specialties and also exhibited a Tracy oil filter, and was represented by Mr. W. R. Mason.

The American Electrical Works was creditably represented by Mr. F. E. Donohoe, western manager, who has proved himself to be a very formidable rival to meet in competition for large orders.

Mr. Louis Nahm, of the American Electric Manufacturing Company of St. Louis, Mo., manufacturers of the "American" lamp, was on hand and made hosts of friends for his house and his lamps.

H. E. Collins & Co.'s interests were looked after by Mr. Alexander Lewis, their Western manager, who did not hesitate to talk up the merits of the Cahall vertical water tube boiler in proper fashion.

J. J. McClare represented the Diamond Incandescent Lamp Company of Denver, Col. "Ozone," combined with the knowledge that he had a good article, made Mr. McClare's representations quite impressive.

Mr. W. E. Burgess, the well-known expert of the Willans central valve engine, represented the interests of the M. C. Bullock Manufacturing Company, which has sold some 110,000 horse-power of these engines.

The merits of the justly celebrated "Clark" wires and cables were advocated by Messrs. George B. Foster and E. W. Cooke, and, it is needless to say, the reputation of Clark insulation did not suffer in their hands.

The Dearborn Drug & Chemical Works, Chicago, in addition to the valuable paper read by their Mr. Willis D. Jameson, were well represented by an attractive exhibit, where they issued to each visitor a humorous "Liar's License," duly filled out.

The Goodrich Hard Rubber Company, of Akron, O., had its charming representative "Josephine" in evidence on every hand, and also numerous and witty screeds on the convenience of using rubber specialties of the Goodrich type.

The Warren Webster Company was represented by Mr. W. D. Pickles, who took advantage of the opportunity to impress on certain members the economical record made by the Webster vacuum heater and the Williames system of heating.

Mr. W. T. Cosper talked up the merits of the Consolidated Car Heating Company's apparatus, and as a result of his eloquence and the merits of his apparatus, many a car will be heated next winter which otherwise might have remained an ice box.

The headquarters of the Fort Wayne Electric Corporation, where Messrs. Buckley, Munson and Wilson held forth, was one of the most popular nooks at the convention. A handsome sign marked the exterior, while a cordial reception awaited all who entered there.

Mr. Geo. W. Conover, the popular western representative of the Perkins Electric Switch Manufacturing Company, of Hartford, Conn., had an attractive exhibit of his company's specialties and made sure that all visitors went away fully impressed with their merits.

The Babcock & Wilcox Company presented to many of the delegates copies of their valuable work on "Steam," that should be in the hands of every steam user in the world. Mr. Wells and Mr. Wilson were ever present to take care of visitors to their headquarters.

Mr. Jos. M. Hill, Chicago representative of the Columbia Incandescent Lamp Company of St. Louis, sustained his reputation as a live, wideawake electrical man. Mr. Hill made a very beautiful display of Columbia lamps and had some vigorously worded circulars for distribution.

Mr. James Wolff, western sales agent of the New York Insulated Wire Company, was everywhere, leaving nothing undone which might possibly add to the comfort or happiness of his many visiting friends. It is safe to say that "Grimshaw" interests in the West are safe while in his hands.

The Central Electric Company, Chicago, had their genial traveler, Mr. H. D. Latimer, on hand with an abundance of good cigars, etc., and with cards of invitations to attend the main exhibit at 173 and 175 Adams Street, which includes a view of the largest and most complete supply house in the world.

Messrs. Grier Brothers looked after the interests of the manufactures they represent in a very creditable manner. "Tommy" Grier was everywhere with samples of China specialties and other goods while Edward Grier was kept busy entertaining friends who called at their office in the Monadnock Building.

The General Electric Company was ably represented by A. C. Bunce and W. J. Ferris. They had on exhibition a fine line of specialties, which attracted unusual attention, and brought forth many favorable comments. Two arc lamps on the hotel circuit served to greatly increase the attractiveness of the exhibit.

Walter C. McKinlock, representing the Metropolitan Electric Company, while causing the P. & B. rooster to crow loudly over some recent large orders for P. & B. insulating compound did not forget to call the attention of visitors to the merits of National India Rubber insulation, and other specialties handled by his company.

The Electric Appliance Company had a very cozy corner, and one that proved to be quite popular at the convention. President Low, assisted by Messrs. Wilson, Wells, Millard and McMaster, succeeded in distributing a considerable number of "high" and "low tension" appliances. Paranite was held aloft, and Packard lamps "punched" throughout the session.

The Osburn Electrical Supply Company, Chicago, was represented by Messrs. Osburn Brothers, who have won a deserved reputation as electrical supply men by building up an excellent trade in comparatively short time. "Harry" Osburn is noted for his sunny disposition and the quiet and convincing manner in which he handles an unruly motor or dynamo.

LIST OF MEMBERS PRESENT AT THE CONVENTION.

ACTIVE MEMBERS.

Carroll Collins, Peoria, Ill.
G. L. Cole, Beloit, Wis.
George A. Farwell, Waukesha, Wis.
C. Gunderson, Madison, Wis.
P. H. Korst, Racine, Wis.
I. P. Lord, Waupaca, Wis.
C. C. Paige, Oshkosh, Wis.
John Schuette, Manitowoc, Wis.
W. H. Thorp, Beaver Dam, Wis.
W. H. Upham, Marshfield, Wis.
J. F. Wiley, Stevens Point, Wis.
Pliny Norcross, Janesville, Wis.
William Goltz, Milwaukee, Wis.
R. F. Kountz, Neillsville, Wis.
T. P. Grover, Wauwatosa, Wis.
F. Overbagh, Chicago, Ill.
George Grimm, Jefferson, Wis.
O. M. Rau, Milwaukee, Wis.
T. R. Mercein, Milwaukee, Wis.
J. S. Stephens, Chicago, Ill.
G. M. Newton, Sparta, Wis
J. H. Harding, La Porte, Ind.
H. O. Woodruff, Sioux City, Ia.
Fred De Land, Chicago, Ill.
E. M. Highlands, Clinton, Ia.
F. A. Copeland, La Crosse, Wis.
M. A. Warren, Baraboo, Wis.
George S. McLaren, Milwaukee, Wis.
Chas. G. Burton, Chicago, Ill.
John C. McMynn, Chicago, Ill.
W. J. Ferris, Chicago, Ill.
Lewis Brittan, Waukegan, Ill.
M. Hussey, Waukegan, Ill.
John B. Whalen, Sycamore, Ill.
J. S. Paulson, Chicago, Ill.
Robert W. Ney, Waukegan, Ill.
Eugene Hall, Burlington, Wis.
E. P. Maxwell, Dixon, Ill.
A. G. Luthy, Peoria, Ill.
Theo. Weberling, Peru, Ill.
R. A. Wilson, Marquette, Mich.

ASSOCIATE MEMBERS.

A. C. Bunce, General Electric Co., Chicago, Ill.
W. W. Low, Electric Appliance Co., Chicago, Ill.
F. McMaster, Electric Appliance Co., Chicago, Ill.
G. A. McKinlock, Central Electric Co., Chicago, Ill.
B. S. Terry, A. W. Harris Oil Co., Chicago, Ill.
M. L. Stevenson, National Carbon Co., Cleveland, O.
H. D. Latimer, Central Electric Co., Chicago, Ill.
S. F. B. Morse, S. F. B. Morse & Co., Chicago, Ill.
George Whyte, Washburn & Moen, Chicago, Ill.
F. N. Boyer, Central Electric Co., Chicago, Ill.
F. E. Donohue, Am. Electric Works, Chicago, Ill.
Loren W. Burch, Metro. Electric Co., Chicago, Ill.
C. E. Gregory, Chas. E. Gregory Co., Chicago, Ill.
John R. Markle, Elec. Stor. Battery Co., Chicago, Ill.
Chas. S. Marshall, Chicago Cross Arm Co., Chicago, Ill.
J. Stedman, Page Belting Co., Chicago, Ill.
W. Wilson, Electric Appliance Co., Chicago, Ill.
James Wolff, N. Y. Ins. Wire Co., Chicago, Ill.
L. H. Cooke, Buckeye Lamp Co., Chicago, Ill.
M. B. Austin, N.Y. Safety Ins. Wire Co., Chicago, Ill.
Channing S. Gage, Washburn & Moen Mfg. Co., Chicago, Ill.
John Valentine, Valentine-Clark Co., Chicago, Ill.
C. D. Wilkinson, Western Electric Co., Chicago, Ill.
W. C. Remington, Elec. Industries, Chicago. Ill.
C. O. Baker, Chicago Gl. Fix. Co., Chicago, Ill.
M. C. Wheaton, Gl. Fix. Co., Chicago, Ill.
W. D. Jameson, "Dearborn Boiler Compounds," Chicago, Ill.
H. S. Hart, Crouse-Tremaine Co., Fostoria, O.

Boiler Feed Waters: Their Treatment.*

BY W. D. JAMESON.

Water becomes impregnated with all different elements in one form or other in which it comes in contact, and absorbs free carbonic acid gas from the air, and ammonia from the air and earth. Carbonic acid gas thus formed becomes the life of the water and enables it to take up the otherwise insoluble carbonates of lime, magnesia, etc., holding them in solution as bicarbonate of lime, magnesia, etc.; the colder the water and the heavier the pressure the more gas it contains, consequently the larger the body of water or the deeper the well, the more heavily impregnated it is with the salts of lime, magnesia, etc.

All natural waters are imbued with the salts of the following mineral bases: lime, magnesia, sodium, potassium, iron, silica and aluminum, combined with carbonate, hydrochloric and sulphuric acids and sometimes medicinal waters with phosphoric acid, or all of them to a more or less extent, according to the nature of the soil or the conditions in which the water percolates the soil.

The calcium, commonly termed lime, is taken up in the form of sulphate and bicarbonate; the magnesia as bicarbonate, sulphate and chloride, the sodium and potassium as chloride, sulphate and carbonate; the iron as bicarbonate; it is also, as well as copper, found in solution as a sulphate; the aluminum exists in the water as a sulphate or in suspension as an oxide, the silica as silicic acid. When we find a water containing sulphate of iron or copper in solution, we generally find free sulphuric acid also.

The salts of lime and magnesia, iron, silica oxide, etc., are scale-forming ingredients; the sulphate of lime forms a very hard compact incrustation which adheres very tenaciously to the hot metal, is very hard to break up, decompose or dissolve, and, like all sulphates, it is a very stable salt. It is conveyed into the boiler by the water as a sulphate, and as such, enters into the scale formation; it is not even soluble in its own acid, and it is impractical to dissolve with hydrochloric acid, except in laboratory work.

The only substances which can be successfully used in the boiler to break up and convert sulphate of lime into a form in which it can be readily washed out, are sugars properly blended, which, when used under the high heat and the existing conditions of the steam boiler, convert this sulphate of lime into a complex mixture of saccharates and carbonate of lime, and this, in the presence of the tannin matters, is partially converted into tannates of lime.

Carbonates of lime and magnesia enter into the scale formation as such, forming a very compact incrustation due to the great chemical affinity they have for hot metal which is also the cause of the adhesive properties of sulphate of lime (gypsum). They can be readily and successfully converted into a complex mixture of tannates of lime and magnesia, without any contamination to the steam or injurious effects to the steam receptacle or its connections.

* A paper, slightly condensed, read before the Chicago meeting of the Northwestern Electrical Association.

Silica enters into the scale formation as such and also as silicate of magnesia. Sodium salts enter into the scale formation only in small quantities, they, being very soluble, remain in solution until the water in the boiler becomes supersaturated and unable to hold a greater quantity. These salts then cake on the hottest parts of the boiler, falling out of solution; this is very dangerous, having been the cause of the burning out of a great many boilers in localities where the feed water is highly impregnated with soda salts; they cause internal corrosion, wasting away of the iron, eating through the joints and connections, and are the cause indirectly of one class of corrosion, which will later be mentioned under another head.

Chlorides of lime and magnesia found in some feed waters are very corrosive agents of the iron, being very unstaple salts, and readily decompose with the high heat, into oxides of lime and magnesia, entering the scale formation as such. The free chloride combines with the hydrogen of the water as hydrochloric acid, and has a direct corrosive action on the iron. The action of sulphate magnesia is very similar to that of the chloride, under the influence of high heat. The sulphates of iron and copper are direct corrosive agents to the iron and boiler connections, and will not enter the scale formation.

It is almost impossible to neutralize sulphates of iron, copper or magnesia in a practical manner. If you do it with soda and convert the sulphuric acid into sulphate of soda, you get an excess of soda salts which sets up galvanic action. If you use lime, converting the sulphuric acid into sulphate of lime you get such large quantities of gypsum that in a short time your boilers will be so full of a hard incrustation that it will be impossible to run them. The only thing ever used which has been half way successful in the handling of soluble sulphates and free sulphuric acid, is a mixture of sugars and starchy matters of a complex organic nature, which have offset the action of the acid by breaking up the acid radical, taking the sulphur and incorporating it with the aid of some of its oxygen, into its own organic compositions.

It is unreasonable to endeavor to treat water for the prevention of the scaling deposits, by the use of sodium and potassium salts, yet these salts are, in 99 cases out of a hundred, the principal ingredient of the so-called boiler compounds and water purifiers, and it is these salts which cause most of the internal corrosion of steam boilers, by their galvanic action.

Where the corrosion is due to chlorine, free hydrochloric or hydrofluoric acids in the water, the pumps and feed pipes are eaten through, the submerged parts of the boiler being free from such action on account of these acids readily passing off with the steam, and a similar action occurs in the steam exposed surfaces of the boiler and the steam piping.

Free sulphuric acid has a very similar action, attacking the feed pipes a great deal more rapidly than the boiler itself; its corrosive action in the boiler is more uniform, and not so much of a pitting and grooving nature, its action in the steam piping having almost entirely a grooving appearance. Where the deleterious action is due to the presence of an acid, it is called a direct corrosive action, and is generally found prominent in the feed pipes (colder pipes), and in the steam exposed surfaces. Where the corrosion takes place mostly in the submerged parts of the boiler, it is generally an indirect action, due to an excess of salts or too pure a water, coming under the head of galvanic action, termed by electricians electrolysis.

The boiler as it is generating steam, is also generating a certain amount of galvanic current. The boiler is a galvanic battery in itself; the valves and their brass connections composed of copper, babbit and other alloys are negative, and the iron positive, forming the negative and positive poles, and under the high heat and other conditions existing in the steam boiler, comprising a galvanic battery. Not only is copper negative to iron, but the very molecules of the iron in the plates and tubes are negative and positive to each other, but electrolysis does not take place in the plate because the impurities, or, we might say, foreign matter, such as silicon, oxygen and carbon compounds, are not, and do not act as conductors between these negative and positive poles; the water in the natural condition, that is, its chemical affinities and solvent properties being satisfied with lime and other natural salts, will not act as a conductor between these poles; consequently, having no conductor, the battery is not connected by water, but when using distilled water, rain water, or water with an excess of sodium salts, there is then a perfect conductor, the water assuming the position of a battery and of a battery solution, connecting the negative and positive poles, and inciting and generating a galvanic current. We then have a true galvanic battery existing, due to the general makeup and influence in the steam boiler. The purer the water or the greater the excess of sodium salts, the stronger the galvanic current, the more pronounced the electrolysis.

Water contains a very corrosive radical in the nature of a hydrate, the hydrate radical is H O. Water is composed of two atoms of hydrogen and one of oxygen, which is a very strong chemical combination not readily decomposed except with a soluble metallic base or red-hot metal, but, in this case, under the influence of the galvanic current, the positive metal, which is iron, exercises a chemical affinity over the water, chemically combining with its hydrate and forming ferric hydrate FeH_3O_3, taking up the oxygen and part of the hydrogen of the water, freeing part of the hydrogen which goes off with the steam. This ferric hydrate gradually converts into corresponding oxides, Fe_2O_3, Fe_3O_4, FeO, due to the high heat and boiling of the solution, gradually converting into its last named oxide, which is the black magnetic oxide of iron; its physical properties are that of a black, gritty powder found at the bottom of the boiler when washed out, when electrolysis is going on. In a boiler that is pitting from this cause there are generally found zigzag pits and grooves coated over with a baked film, and by tapping this with the hammer a reddish-brown, soft powder is found underneath, which is the more freshly formed ferric hydrate; that of a lighter shade is the partly converted oxides, and the few handsful of black gritty powder from the bottom of the boiler, which can be examined after rinsing out the other oxides, will be the black magnetic oxide of iron.

Electrolysis which, from the present standpoint, can be termed galvanic action, truly exists as such, and in large ocean-going vessels causes much trouble; there tons of zinc are used to offset this action, due partially to using too pure a water on account of the hot-well system, and incited further by the salt water used. It is known that zinc is one of the most positive metals known in galvanic battery work, being more positive than iron; the zinc put into the boiler assumes the position of the positive pole, consequently it is destroyed in place of the iron, by the battery solution in the steam boiler; its reaction and conversion into its oxide is similar to that of the iron, it being destroyed under the same influences.

Of all the deleterious actions which take place in steam boilers this is the easiest to handle, for you simply need to satisfy that water with some vegetable starch and saccharine matter, and in that way break up the conductor between the negative and positive poles, whether they be brass connections (negative) and the boiler plate and flues (positive) or the molecules of the iron of the boiler plate. It is impossible to set up a galvanic action without the water assuming the position of the battery and acting as the conductor. This same saccharine inert matter in conjunction with tannin extracts will cause the pits and grooves in the iron plate (where the case hardening protective surface of the plate and tube is broken and the raw steel or iron exposed) to heal over, assuming the same case hardening appearance as before. Do not understand me to say that you can fill up the little holes, as that cannot be done, the iron being gone, but the surface of these little zigzag holes and pits will heal over, serving as a protection against the water or the atmospheric oxidation.

Scaling ingredients are converted from crystallizable scale-forming carbonates and sulphates having a great affinity for hot metal into non-crystallizable tannates and saccbrates of lime and magnesia, being a complex mixture of these with some carbonate, the sodium salts being readily handled in the same manner. This complex mixture of the saccbrates, carbonates and partially converted tannates, is of an inert nature, having the physical properties of a soft oozy mud of the same specific gravity as the water, and no affinity for hot metals; neither has it the clay-like properties, but will readily wash out with the water when cleaning the boiler.

In conclusion I might say a few words relative to the deleterious action of oil in steam boilers. Many of you to-day are running large condensing plants with your hot well system, and you are getting oil, with the condensation, into the boilers, possibly five to 15 drops per gallon. Oil separators are a good thing, and do possibly 50 or 60 per cent. of the work. You often hear of the tubes in a water tube boiler buckling up and having to be taken out; you often hear of the bagging of the fire sheet in tubular boilers; why is this? The specific gravity of the oil is lighter than that of the water, the oil does not settle in its natural state. We explain it as follows: The oil coming into the boiler floats on the water; there is just a sufficient quantity of fresh water coming in to convey salts of lime, magnesia, etc., which are thrown out of solution, chemically

combining with the animal oil as insoluble oleates, and mechanically combining with the mineral oils as a heavy mass; both these chemical and mechanical combinations being of a greater specific gravity than the water in the form of little globules, they sink to the bottom, the great chemical affinity and adhesive properties of this mixture causing them to adhere to the hot metal, and they being a perfect non-conductor comparing with iron as 1 to 110, retarding the transmission of the heat units to the water, concentrating the heat in that part of the plate, causing the iron to become unduly heated, and the pressure in the boiler forces it down.

Sodium salts so commonly found in water, or where it is used to counteract this action, saponifies the oil, causing the boilers to foam and carry over into the engines, and should not be used; this can be successfully handled with tannin extracts, the tannates forming complex organic compositions with the oils, of an inert light powdery nature, having no chemical affinity or physical adhesive properties, and readily washing out with the water at the opening of the boiler. To prove this, go to the tannery and watch the tanner take the hides out of his vat after he is through with the tanning process, and when he lets his liquor run out of the vat, you will find two or three scoop shovels full of an inert powder which readily dries out and is termed pure tannin by the tannin experts. They claim that this is insoluble, and are in want of a solvent so that they can successfully use it for its tanning properties. We do not believe this to be the case, as the tannin in this mixture is, chemically speaking, part of the mixture and the tannin is satisfied by the fatty matters contained in the hide. We aim to get this same reaction with the oil, by pumping into the boiler a properly blended mixture of slippery elm, starches, sugars and tannin extracts. We have found that we can successfully cope with most of the deleterious actions taking place in steam boilers with vegetable matters and vegetable matters only sometimes using from 5 to 10 per cent. of carbonate of soda to partially cut the starches and aid in the action of the sugars, and do not believe that perfect results can be obtained from any other methods known to science.

General Electric and Its Schenectady Plant.

At a meeting last week of a municipal commission appointed to appraise the land along Kreusi Avenue, Schenectady, which it is proposed to donate to the General Electric Company, Second Vice-President Orr was examined as to the plans of his company with respect to the Schenectady plant.

In reply to interrogations Mr. Orr stated that the General Electric Company employed 2,000 men at its Lynn works, 900 at the Harrison, N. J., lamp works, and 4,400 men at Schenectady, the weekly payroll at latter place being $45,000. The main object of the inquiry was to determine the truth of rumors to the effect that the company intended to remove its works from Schenectady, and we give below the gist of the testimony elicited on this point. Mr. Orr, in answer to a questions, said that immediately after the formation of the General Electric Company, the question of concentrating factories at one point arose, and they did, in fact, remove a large amount of work from Lynn to Schenectady, and also removed the engineering and designing forces from Lynn and the general offices from New York to Schenectady, the directors stating in their second annual report to the stockholders "so far as practicable your manufacturing business has been and will be concentrated at Schenectady." This question, he stated, has been considered in all its aspects continuously from the organization of the General Electric Company, and is now being considered. The directors directed the officers of the company to examine and report on taking immediate steps to increase the output of the Schenectady factory 25 per cent. In making this examination and report the officers were confronted with the bad layout of the Schenectady plant. Electric machinery has been increasing in size very rapidly during the past two years. Within the last few weeks the largest casting, weighing 45 tons, ever made for an electric machine of its kind in this country, if not in the world, has been made at Schenectady. Moving large castings is very expensive, and economical manufacturing requires that they should go direct from a foundry into one end of a long building in which electric cranes can handle them at every operation, and where they can be finished, erected, tested and finally loaded on cars for shipment at the other end of the same building. The officers reported that the output of Schenectady could not be increased without large extensions to existing buildings, and they did not consider it practicable to erect such buildings.

Asked why this was so, Mr. Orr said that the land on which the Schenectady plant is situated is bounded on one side by the New York Central embankment and on the other by the Erie Canal. It is in the shape of a triangle, and is cut in two obliquely by Kruesi Avenue at such an angle that it is impossible to lengthen the existing buildings without taking away the necessary yard room for switching cars. The officers reported, therefore, that it was impossible to erect on this land buildings 1,000 or 1,500 feet long which, as has been explained above, are necessary for economical manufacturing, and which the company should have in order to compete with manufacturers who do not have to cart heavy castings around a 30-acre lot from one building to another. All the valuable space in the triangular piece of land which is described above is now filled with buildings with the exception of the necessary yard room which any large manufacturing concern must have. The officers reported that no feasible way could be found to greatly enlarge the capacity of the Schenectady plant, and further reported that the situation of that plant was so unfortunate that in their opinion it would be unwise to spend any more money upon it.

In reply to a question whether proposals had been made to the General Electric Company offering to donate land and money upon condition of its removal, it was answered that about six months ago a gentleman who had been the head of one of the most important departments of the company, and was familiar with the need of further manufacturing facilities, proposed on behalf of people of large means and of well-known reputation, to donate 75 acres of land and erect buildings thereon, near a large manufacturing centre, where there is a good machine labor market, and it became known to many of the employees that the question of moving the Schenectady plant was being considered. The effect of the proposals becoming known to people interested in lands adjacent to a large city in New York State, these people entered into negotiations with us looking to the donation of 100 acres of land and $1,000,000 in cash as a consideration of our removal.

In reply to a question as to whether representatives of the company had examined the proposed location and made estimates for the cost of construction of new buildings, loss by abandonment, etc., it was said that this was done, and that they advised that the economies to be obtained by the concentration of all manufacturing interests at some one point other than Schenectady would, in their opinion, justify such concentration. The two places referred to above have better railway facilities, a better labor market, and much cheaper coal, and the estimates showed that the reduced cost of manufacturing would greatly exceed the cost of removal, and would justify the loss which would have to be suffered on real estate and buildings. It was added that the most valuable part of their plants is the machinery, which can be readily moved.

The negotiations above referred to, Mr. Orr said, are now pending, and in his opinion would have taken definite form had not a committee of the Schenectady Board of Trade written to the directors of the General Electric Company that the citizens of Schenectady desired to be heard on the question of removal, and would do all in their power to furnish additional space and to counteract as far as possible the objections to its remaining. These representations were considered by the board of directors, and the negotiations with the other parties referred to were temporarily suspended, awaiting the determination of proceedings which have been commenced to enable them to enlarge. The matter was left and is now in the hands of the executive committee of the board of directors.

Mr. Orr stated that he is, so far as he knows, the only general officer of the company who does not deem it advisable to remove. The others all believe that, looking to the future of the General Electric Company's business, say ten years hence, it is wiser and cheaper now to abandon wholly the Schenectady plant. This feeling is so strong that although nearly a year ago the erection of a new building, 92 feet by 250 feet, was authorized, and although specifications were given to builders and bids received, contracts have not been let on account of the uncertainty of remaining here, it being the unanimous opinion that if the Schenectady plant was not permanent there, not another cent should be spent on it.

Mr. Orr said that he is absolutely of the opinion that the question whether his company should be allowed to have the road bed of Kruesi Avenue opposite its works, and the land between its land and the Delaware & Hudson Railway Company, is one of vital importance in the determination of whether or no the company will concentrate at Schenectady. He said that in his opinion if Kreusi Avenue can be closed, and the property required be ceded to the company, the largest electrical manufacturing establishment in this country will be located permanently in Schenectady, and in due

time the number of men now employed will be doubled, but added that in the discussions which have taken place between the officers, he had not been able to refute the arguments they make in favor of removal.

The Monocyclic System.

Having received many requests for an explanation of the monocyclic system in brief and simple language, Mr. C. P. Steinmetz, at our request, has prepared the following note which, we believe, will make its features thoroughly plain to all of our readers.

The monocyclic system was designed to replace the old type single-phase system of alternating-current distribution by offering

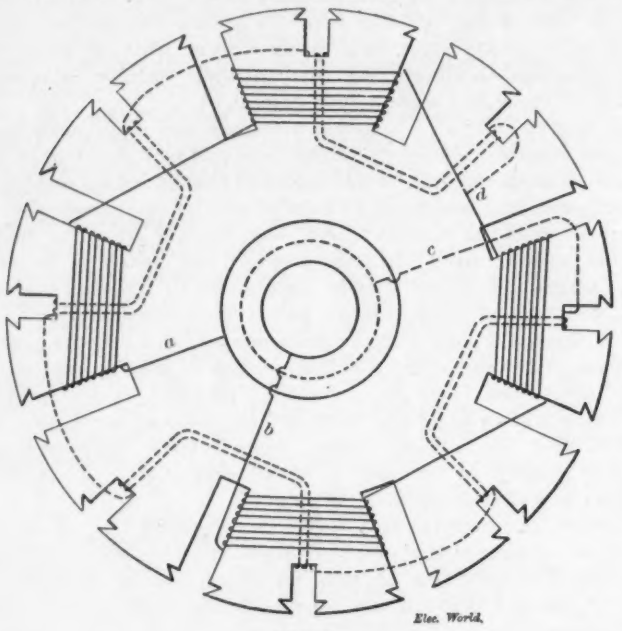


FIG. 1.

among other features the advantage of being able to supply power to alternating-current motors which are self starting under full load.

The monocyclic generators differ from the old single phasers only by having midway between the main slots a second set of small and shallow slots, as shown in Fig. 1, which contain a supplementary or teaser winding shown in dotted lines.

The conductors of the teaser coils are of the same cross-section as those of the main coils, but the former contain only one quarter the number of turns of the main coils, and thus give only one quarter the E. M. F. The teaser winding is connected with one end to the third or middle collector ring, and the other end to the middle of the main winding, as shown diagrammatically in Fig. 2.

In this way, the teaser current has to return over the main coil, and thus meets beside the self-induction of the teaser, also the self-induction of the main winding. This feature, in combination with the higher impedance of the teaser line, as compared with its voltage, is made use of to limit the flow of current in the teaser circuit,

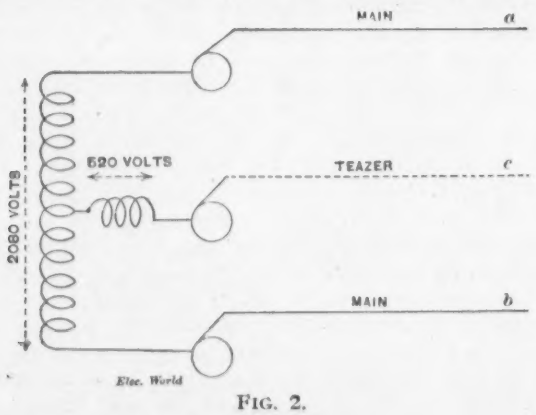


FIG. 2.

by dropping the voltage of that circuit as soon as current is taken off, and thereby maintaining the flow of power fluctuating in the same way as it is in the old single-phase system.

The teaser voltage of the generator cannot be measured directly, since only one terminal for the teaser winding is accessible. The potential difference between the main or outside collector rings is that of the main coil. The difference of potential between the middle or teaser collector ring and any one of the main collector rings is the resultant of the teaser voltage and half the main voltage.

Since the teaser voltage at open circuit is .25 of the main voltage, the voltage between teaser and main collector ring is $e = V.252 + .52 = .57$ of the main voltage.

For the operation of standard induction motors, the primary voltage is transformed either by two transformers of equal size, as shown diagrammatically in Fig. 4, or by a large or main, and a small or teaser, transformer, as shown in Fig. 6.

The diagram of E. M. Fs. corresponding to Fig. 4 is shown in Fig. 3, *ab* being the primary main, and *cd* the primary teaser,

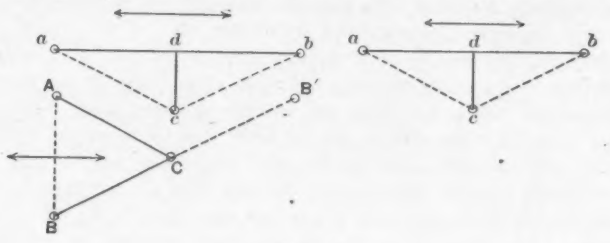


FIG. 3.

voltage. Thus the dotted lines *ac* and *cb* are the resultant voltages between main and teaser wires, differing from each other by somewhat less than 60 degrees. By transformation, *ac* changes to *AC*, and *cb* to *CB*^{1}. Since, however, this secondary coil is reversed, the secondary voltage becomes *CB*, and thus gives the secondary triangle *ABC*, of which the side *AB* is the product of twice the teaser voltage by the ratio of transformation, while the sides *AC* and *BC* are resultant voltages of main and teaser. The energy cur-

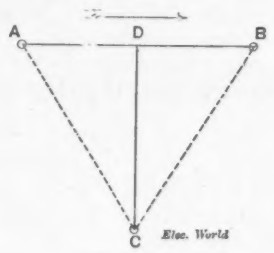
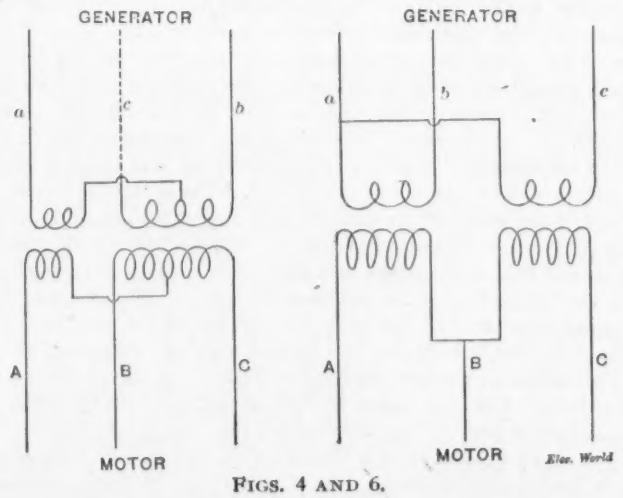


FIG. 5.

rent supplied to the motor over the wire *C*, divides and returns partly over *A*, partly over *B*.

By transformation by means of main and teaser transformer, shown as E. M. F. diagram, Fig. 5, the teaser voltage *cd* is transformed at a different ratio from the main voltage *ab*, and thus changes the altitude *cd* of the primary triangle *abc* to that of the secondary triangle *ACB*, which is such as to give nearly an equilateral triangle. However, though the secondary E. M. Fs. give



FIGS. 4 AND 6.

approximately an equilateral triangle, the flow of current, due to the inability of the teaser to supply large currents, remains practically in phase with the main E. M. F.; that is, neglecting the angle of lag of the motor, it would be in the direction marked by arrows in Fig. 3 and 5.

The Invention of the Electromagnetic Telegraph.—II.

BY FRANCIS W. JONES.

PROFILE OF MORSE.

MR. VAIL'S book was the first work ever published on the Electric Telegraph, and was the only one in the English language up to 1852, and its careful perusal will convince the reader of Vail's thorough mastery of the subject at such an early day in the history of the art, and also of the wide field he covered in his investigations. Vail begins his book by a very clear description of the Electric Magnetic Telegraph as it was operated between Washington and Baltimore in 1844, alluding but very briefly to the plan embraced in the caveat of Morse.

After describing minutely the Grove battery, and the register (which was self-starting and stopping), on page 22 a cut is given of the key, the circuit of which is shown open at the points of contact, but which were kept closed by a metallic wedge, when not used to signal. (See Fig. 4).

Next the Baltimore and Washington circuits are illustrated and described. The two used for the first operation of the telegraph until the close of the session of Congress, June, 1844, started from a sheet of copper in the water at the bottom of the dock near the depot of the B. & O. Ry., Pratt Street, Baltimore, and ended in Washington, with an independent battery in each wire at Baltimore. After the close of the session, Vail arranged both wires between Baltimore and Washington so they worked from one ground and battery at Baltimore to one ground in Washington. On page 24 he says: "This arrangement, by which one battery is made efficient for both circuits at the same time, where two were formerly used, was devised by Vail, assistant superintendent in the spring of 1844."

On page 153 of this book Vail says: "From a letter now in the possession of the author, and addressed to him by Prof. Morse, we make the following extract:

" 'In 1826 the lectures, before the New York Atheneum, of Dr. J. F. Dana, who was my particular friend, gave to me the first knowledge ever possessed of electromagnetism, and some of the properties of the *electromagnet*, a knowledge which I made available in 1832 as the basis of my own plan of an electric telegraph. I claim to be the original suggestor and inventor of the electric magnetic telegraph, on the 19th of October, 1832, on board the packet ship *Sully*, on my voyage from France to the United States, and, *consequently*, the inventor of the first really *practicable telegraph on the electric principle*. The plan then conceived and drawn out in all its essential characteristics is the one now in successful operation. All the telegraphs in Europe, which are practicable, are based on a different principle, and *without an exception* were invented subsequently to mine. The thought occurred to me in a general conversation, as seated at the table with the passengers, in which the experiments of Franklin to ascertain the velocity of electricity through three or four miles was discussed. The thought at once occurred to me that electricity might be made the means of conveying intelligence, and that a system of signs might easily be devised for the purpose. I ought, perhaps, to say that the conception of the idea of an electric telegraph was original with me at that time, and I supposed that I was the first that had ever associated the two words together; nor was it until my invention was completed, and had been successfully operated through ten miles, that I for the first time learned that the idea of an electric telegraph had been conceived by another. To me it was original, and its total dissimilarity from all the inventions, and even suggestions of others, may be thus accounted for. I had not the remotest hint from others till my whole invention was in successful operation. I employed myself in the wakeful hours of the night, as well as in the tedious hours of the day, *in devising the signs, adapting them to a single circuit of wire, and in constructing machinery which should record the signs upon paper*, for I thought of no plan short of a mode of recording.'

"On the 2d of September, 1837, the author, with several others, witnessed the first exhibition of this electric telegraph, and soon after became a partner with the inventor. Immediate steps were taken for constructing an instrument for the purpose of exhibiting its powers before the members of Congress.

"This was done at the Speedwell Iron Works, Morristown, N. J., and exhibited in operation with a circuit of two miles. A few days after it was again exhibited at the University of the City of New York for several days to a large number of invited ladies and gentlemen. The circuit at this time was increased to 10 miles. Immediately after this exhibition the instruments and 10 miles of wire were taken to Washington, and continued in operation for several months in the room of the Committee on Commerce at the Capitol. Its history and progress after this period may be gathered from the preceding documents printed by order of Congress."

MORSE AS HE APPEARED WHEN STRUGGLING FOR RECOGNITION.

On page 26, after describing the register, Vail says in a foot note: "The first working model of the telegraph was furnished with a lead pencil for writing its characters upon paper. This was found to require too much attention as it needed frequent sharpening, and in other respects was found inferior to a pen of peculiar construction, which was afterward substituted.

"This pen was supplied with ink from a reservoir attached to it. It answered well, so long as care was taken to keep up a proper supply of ink, which from the character of the letters, and sometimes the rapid and others the slow rate of writing, was found to be difficult and troublesome. And then again, if the pen ceased writing for a little time the ink evaporated and left a sediment in the pen, requiring it to be cleaned before it was again in writing order. These difficulties turned the attention of the inventor to other modes of writing differing from the two previous modes. A variety of experiments were made, and among them one upon the principle of the manifold letter writers; and which answered the purpose very well for a short time. This plan was also found objectionable, and after much time and expense expended upon it, it was thrown aside for the present mode of marking the telegraphic letter. This mode has been found to answer in every respect all that could be desired. It produces an impression upon the paper not to be mistaken. It is clean, and the points making the impression being of the very hardest steel do not wear, and renders the writing apparatus always ready for use."

Fig. 5 shows the register thus described.

On page 27 the alphabet as at present used in this country is

shown as in Fig. 6, and examples of its use are given upon the two following pages.

The first example is translated as follows:

"The American Electromagnetic Telegraph invented by Prof. S. F. B. Morse, of New York, on board of the packet ship *Sully* (Capt. Pell), on her passage from Havre to New York, October, 1832."

Vail says: "By examining the telegraphic alphabet the characters will be found to be made up of dots, short and long lines—and short and long spaces. A single touch of the key answers to a single dot on the paper of the register, which represents the letter 'E.'"

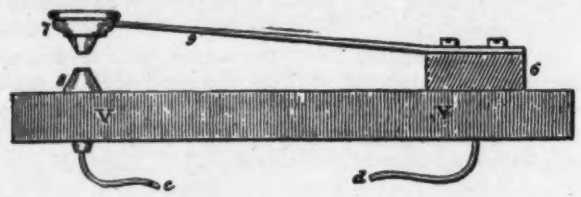


FIG. 4.—FIRST TELEGRAPH KEY.

On page 30 is found the following: "This conventional alphabet was originated on board the packet *Sully*, by Prof. Morse, the very first elements of the invention, and arose from the necessity of the case; the motion produced by the magnet being limited to a single action.

"During the period of 13 years, many plans have been devised by the inventor (Morse) to bring the telegraphic alphabet to its simplest form. The plan of using the common letters of the alphabet, 26 in number, with 26 wires, one wire to each letter, has received its due share of his time and thought. Other modes of using the common letters of the alphabet, with a single wire, has also been under his consideration. Plans of using two, three, four, five and six wires to one registering machine have, in their turn, received proportionate study and deliberation. But these and many other plans, after much care and many experiments, have been discarded; *he* being satisfied that they do not possess that essential element, *simplicity*, which belongs to his original first thought, and the one which he has adopted." On page 32 Vail says: "The modes of manipulation for sending intelligence, which at various times have been invented by Prof. Morse, are more various than any other part of the machinery of the telegraph. A few of them will now be described.

"The first method, invented as early as the year 1832, was that of using type resembling saw teeth set up in long frames and made to pass under a lever by means of machinery, at a uniform rate, for the purpose of closing and breaking the circuit in a manner hereafter to be described. Figure 7 represents the saw teeth type.

"The top of the narrow tooth corresponds with the *dots* of the letters, and the long tooth with the *lines* of the letters. For instance, *A* has one tooth for a dot and a long tooth for a line, which is the telegraphic letter *A;* then follows a space at the end of the type, corresponding with the short space between two letters."

On page 41 is shown an improved key (Fig. 8) and described as a modification of the one previously shown, and designed to make more perfect contacts. Vail says: "A key of this form has been used during the past winter for reporting the proceedings of Congress and has been found to operate with ease, with certainty and with great rapidity. *A A* is the block or table to which the parts are secured. *E* represents the anvil block. *J* the anvil, screwed into the block, both of brass. *B* is another block, for the stop anvil, *K*, and the standard for the axis of the lever *C*. *L* is the hammer, and is screwed into the lever, projecting downward at *V*, almost in contact with the anvil, *J*. *R* is another screw of the same kind, but in contact with the anvil, *K*, when the lever *C* is not pressed upon. *D* is a spring which sustains the arm of the key cup, preventing the hammer *L* from making contact with the anvil *J* when not in use. *G* is a screw connecting with the brass block *B*, and *F* a screw connecting with the block *E*. To these screws the two wires, *I* and *H*, of the battery are connected."

FIG. 6.

The time referred to by Vail is undoubtedly the winter of 1844-1845. Foot note on page 44 says: "Franklin appears to have been the first, or among the first, who used the ground as part of a conducting circuit in the performance of electrical experiments. Steinheil, it appears, was the first to use the ground as a conductor for magneto electricity. Bain, in 1840, was the first to use the ground as a source of electricity in conjunction with its conducting power, as a circuit. Prof. Morse has since the establishment of the telegraphic line used the ground as half the line, with perfect success, employing the battery; and Mr. Vail, in an experiment in 1844, succeeded in operating the electromagnet, with its armature attached to a lever without any battery."

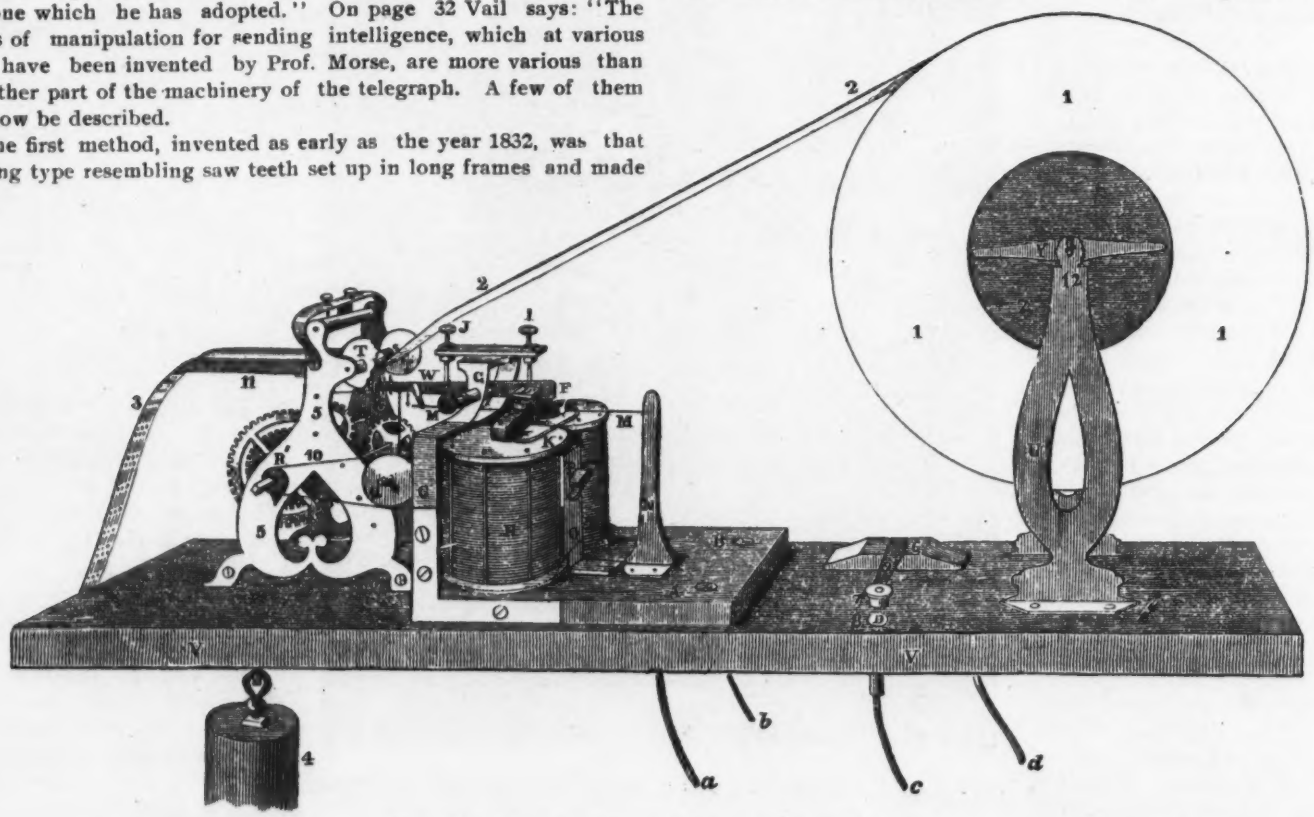


FIG. 5.—REGISTER DESCRIBED IN VAIL'S BOOK.

On page 159 is a full description of "Electromagnetic Printing Telegraph," invented by Alfred Vail, September, 1837, and in the introductory remarks Mr. Vail says: "Soon after my connection

with Prof. Morse as co-partner, and at the time I was constructing an instrument for exhibiting the advantages of his telegraph to a committee of Congress, it occurred to me that a plan might be devised by means of which the letters of the alphabet could be employed in recording telegraphic messages. I immediately gave my attention to the following plan" [occupying several pages of illustrated description in which Vail says he considers the system "inferior to the mode now adopted by Prof. Morse."].

On page 156 is given a description of Schilling's Telegraph taken from the *Polytechnic Central Journal* of 1838 showing a code of signals adapted to the right and left movements of a galvanometer needle; thus, one move right and one left represented "A" and so on. Also, a description and illustration from the same journal of "The Electromagnetic Telegraph of Counsellor Gauss and Prof. William Weber, invented Gottingen, 1833," and Vail adds the remark, "It will be seen that by representing the letters and numerals with these variously combined deflections of the needle, words and sentences may be transmitted."

The systems of Wheatstone, Steinheil, Davy and others are also clearly shown in Vail's work.

In letters of Morse to Vail, published in Prime's "Life of Morse," pages 325 and 326, it is shown that on Oct. 11, 1837, Morse was at work on the dictionary for the translation of his telegraphic characters and completed it on Oct. 24. On page 327 it is also shown that Gale was actively engaged on Nov. 13 in assisting Morse, and that both Morse and Gale intended to visit Morristown, N. J., and make experiments as soon as Vail had the new apparatus ready and

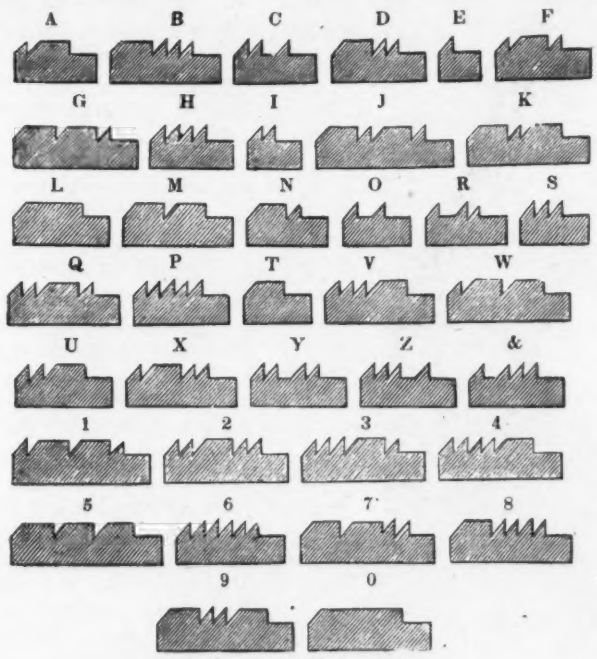


FIG. 7.—SAW-TOOTH TYPE.

to take along the "Dictionary." Morse, in these letters to Vail, was giving instructions to Vail, and informing him of the progress that was being made at the University, New York, with batteries and electromagnets, for the test. This experiment was made Jan. 6, 1838, in Morristown, N. J., and an account was published in the *Morristown Journal*, which stated "The communication which we saw made through a distance of two miles was the following sentence: '*Railway cars just arrived 345 passengers.*'" The *Morristown Journal* further states that the foregoing sentence was set up in telegraph type in the port rule, and run through it in about half a minute, reproducing the signals upon the register instantaneously, over two miles of wire, which "were easily legible and *by means of the dictionary* were resolved again into words." (See Prime's "Life of Morse," page 330.)

This new apparatus was brought to the University Building in New York City, and an exhibition of transmitting signals through ten miles of wire was given by Morse on Jan. 24, 1838, to some invited guests. On this occasion Prof. Morse worked the port rule, and transmitted the following sentence, probably the first ever recorded by the dot and dash code of signals:

"ATTENTION, THE UNIVERSE!
BY KINGDOMS, RIGHT WHEEL!"

a facsimile of which is shown on page 332 of Prime's work, and is reproduced in part by Fig. 9.

An account of this exhibition was published in the *Journal of Commerce*, Jan. 29, 1838, and the following is an extract: "Prof. Morse has recently improved on his mode of marking by which he can dispense altogether with the telegraphic dictionary, using *letters* instead of *numbers*, and he can transmit ten words per minute, which is more than double the number which can be transmitted by means of the dictionary." (Vide, page 332, Ibid.)

It will be seen that in the Morristown experiment, on Jan. 6, 1838, the Morse numeral code and dictionary were used, and the signals recorded on the new register constructed by Vail and in the

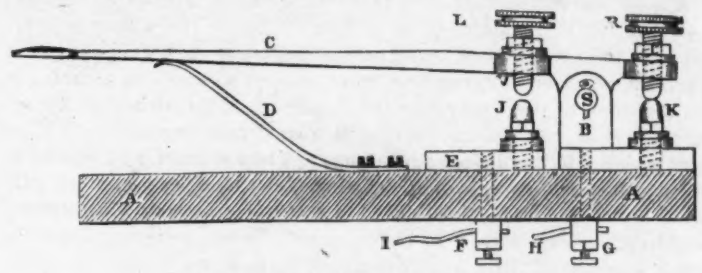


FIG. 8.—IMPROVED KEY OF 1845.

New York experiment, *eighteen days* later, with the *same* apparatus the dot-and-dash code without a dictionary was employed, so that there is no ground for believing that the register was constructed by Vail to meet any changes he may have proposed in the original Morse numeral code. Referring to the translation of the complete sentence, "Attention, the Universe, etc.," as transmitted on Jan. 24, 1838, part of which is shown in Fig. 9, the letter *B* was represented by three dots and a dash, and *V* by a dash and three dots, exactly the opposite of the present Morse code. It will also be noticed that the letters *e*, *h*, *k*, *l*, and *n*, are represented by the same characters embraced in the patent application of Morse dated the following April 7th. The remaining characters are identical with the modern Morse code, excepting the letters *b*, *v*, and *y*; the latter letter being represented by two dots which now constitute the letter *i*.

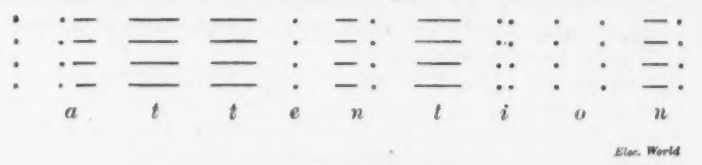
The new apparatus was exhibited before the Committee of Science and Arts in the Franklin Institute in Philadelphia, on Feb. 8, 1838, and before the President, Cabinet and Committee of Commerce in Washington on Feb. 21 following.

On page 345 of Prime's work is also given a copy of a letter from Morse to Vail, dated March 31, 1838, saying: "I have overcome all difficulties in regard to a port rule, and have invented one which will be perfect," and on the same page in a letter from Vail to Morse, dated March 19, Vail says: "I feel, Prof. Morse, that if I am ever worth anything it will be wholly attributable to your kindness."

Since a reference has been made in a recent number of the *Telegraph Age* to a letter written in 1839 by Joseph Henry to Morse, it is right also to reproduce impartially the testimony given later by Henry in the case of Smith vs. Downing (see evidence page 90), as follows: "I am not aware that Mr. Morse has ever made a single original discovery in electricity, magnetism, or electromagnetism, applicable to the invention of the telegraph. I have always considered his merit to consist in combining and applying the discoveries of others in the invention of a particular instrument and process for telegraph purposes."

In his application in 1854 for an extension of his patent, Morse's counsel addressed the Commissioner of Patents as follows:

"As to the inventor's diligence in perfecting and introducing this invention into use, this case presents itself to the Commissioner in



Elec. World

FIG. 9.

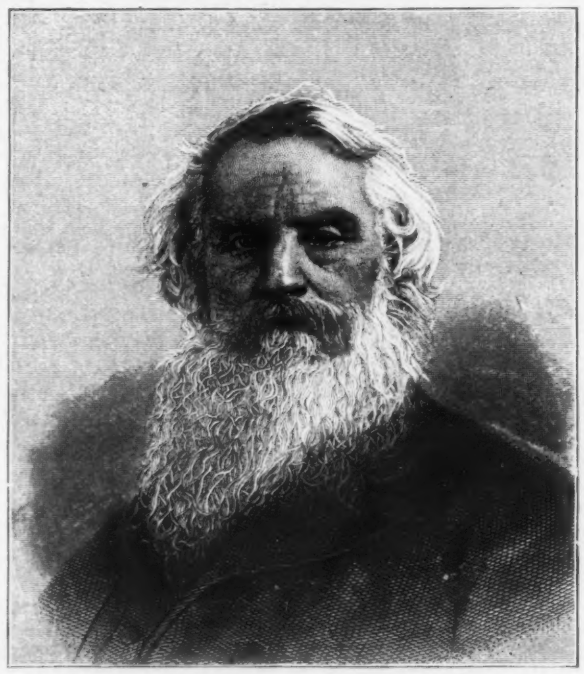
the strongest possible light. The history of this invention is one of 14 years of toil and devotion by Morse to his project amid difficulties, privations, sneers and disappointments; to this succeeded a period of eight years of treachery on the part of agents and associates, public defamation, infringements and law suits. This has occupied the time almost down to the very hour of filing this application. Finally, when worn down with these struggles of the 14

years of the life of the patent and the 63d of the inventor, the highest judicial tribunal in the world unanimously awarded to him the proud honor of being the '*original inventor of the Electromagnetic Telegraph.*' The detail of Morse's diligent labors and toils to perfect and introduce his telegraph are clearly and truthfully set out in his statement on file. The prejudice and opposition of the public, and the indifference of the government, and the aversion manifested by capitalists to his scheme, are set forth in the testimony of his brother, Sidney Morse, Hon. Louis McLane, B. B. French, George Vail and Charles R. Dodge, on file in the case."

Testimony was furnished in this case by B. B. French as follows:

"Prof. S. F. B. Morse came to Washington in the winter of 1837-38 with his invention of a magnetic telegraph, and exhibited it to such members of Congress and other persons as chose to examine it in the room of the Committee on Commerce of the House of Representatives of the United States. It was then a cumbrous affair, as compared with its present appearance. The Professor had ten miles of wire in a coil upon a cylinder, through which he passed his galvanic current. I was introduced to Prof. Morse at Washington, and took a deep interest in his telegraph, firmly believing from his explanations and my own examination and study that it would work. The Committee on Commerce made a favorable report on the subject, but nothing further was done at that season. The Professor was very anxious to obtain an appropriation to test the merits of his telegraph, and urged it upon Congress with great zeal.

"In May, 1838, Prof. Morse sailed for Europe, his object being, as he informed me, to secure patents from the governments of that portion of the world for his invention. He returned to America prior to 1842, and during the winter of that year came again to Washington, with his invention greatly improved, very nearly in the shape that it now is. He placed a register in the room of the Committee of Commerce of the House of Representatives, and another in the committee room of naval affairs of the Senate, they being the south and north rooms of the centre building of the Capitol, and messages were sent from one room to the other over the wires connecting the two instruments. At that time I was daily with Prof. Morse, and he and his friends were as diligent as men could well be, not only in endeavors to obtain from Congress an appropriation to test the invention, but in endeavoring to enlist private enterprise in it. In March, 1843, a bill was passed appropriating thirty thousand dollars to test the invention."



Morse as He Appeared After Receiving Recognition.

George Vail also gave the following testimony before the Commissioner of Patents at the same time:

"The great mass of intelligent men regarded the magnetic telegraph as a mere visionary scheme, from which nothing useful could ever be realized, and Prof. Morse was looked upon as a clever and ingenious man, but scarcely of sane mind, because he proposed the telegraph as a medium for the regular communication of intelligence between distant places in view of the peculiar difficulties encountered in bringing this invention into public and general use, mainly, if not wholly attributable to the absence of public confidence in its practicability."

In the *Journal of the Telegraph*, March 1, 1872, is published a letter, dated Washington, D. C., Jan. 12, 1872, to Henry J. Rogers, "Corresponding secretary, etc.," and signed by Prof. Leonard D. Gale, who was thoroughly familiar with the birth and development of the telegraph system of Morse, to whom Gale rendered valuable assistance. As will be seen, this letter was written at a time when there was at stake no pecuniary interests of either of the original proprietors of the Morse invention, and when the only object Gale could have had was to give credit to whom he believed credit to be due. The letter is as follows:

"I have just read a letter from F. O. J. Smith, dated Dec. 11, 1871, addressed to you, and designed to throw discredit on Morse's invention of the telegraph, the burden of which seems to be rebuke to the designer of the monument for elevating Morse to the apex of the monument, and claiming for Prof. Henry, of the Smithsonian Institution, that high distinction.

"The first question of the impartial inquirer is, to which of these gentlemen is the honor due? To ascertain this we will ask a second question. Was the subject of the invention a *machine?* or was it a *new fact in science?* the former was Morse's, the latter was Henry's. The answer is, it was a *machine.* Henry stated that electric currents might be sent through long distances, applicable to telegraphic purposes. Morse took the facts as they then existed, invented a machine, harnessed the steed therein, and set the creature to work. There is honor due to Henry for his great discovery of the scientific principle, there is honor also due to Morse for the invention of the ingenious machine which accomplishes the work.

"Men of science regard the discovery of a *new fact* in *science* as a higher attainment than the application of it to useful purposes, while the world at large regard the *application* of the principle or fact in science to the useful arts as of paramount importance. All honor to the discoverer of a new fact in science; equal honor to him who utilizes that fact for the benefit of mankind.

"Has the world forgotten what Robert Fulton did for the navigation of waters by steamboats? It was he who first applied steam to propel a vessel, and navigated the Hudson for the first time with steam and paddle wheels and vessel in 1807. Do we not honor him as the father of steamboats? Yet Fulton did not invent steam, nor the steam engine, nor paddle wheels, nor the vessel; he merely adapted a steam engine to a vessel armed with paddle wheels.

"The *combination* was his invention. There is another example on record: Cyrus H. McCormick, the father of the reaping and mowing machine, took out the first successful patent in 1837, and is justly acknowledged the world over as the inventor of this great machine. Although 146 patents were granted in England previous to McCormick's time, they were but so many unsuccessful efforts to perfect a practical machine.

"Yet it is equally true that McCormick did not invent one original device used in his celebrated machine. The cutting apparatus, the device to raise and lower the cutters, the levers, the platform, the wheel, the framework, had all been used before McCormick's time. But McCormick was the first genius able to put these separate devices together in a practicable, harmonious operation. The *combination* was his invention. Morse did more: he invented the form of the various parts of his machines, as well as their combination. He was the first to put such a machine into practical operation, and for such a purpose. Who can question his title as the inventor of the telegraph?"

As a matter of fairness to all, one more thing requires to be introduced in this connection bearing on the invention of the signaling key.

Thomas C. Avery, a philosophical instrument maker of New York, was engaged to assist Morse in his first attempt to lay his telegraph wires underground between Baltimore and Washington.

In the trial of Benj. B. French vs. Henry J. Rogers, for infringement of Morse patents by the use of the Bain system, tried in Philadelphia in 1851, on page 434 of testimony for the defence, Avery deposes as follows: "Upon making our experiments on the line almost everything was a failure. The original plan of laying the wires in pipes underground was a total failure, and was abandoned. The battery with siphon tubes was a failure and was abandoned. The relay magnets, six in number, were not sufficiently delicate. I was obliged to alter the journals to work on agate points which made them work with more delicacy, and thereby Mr. Morse was enabled to work with a half quantity battery. The adjustment of the agate points was my own invention. Mr. Morse

was not present. Mr. Vail was, but did not know what an agate point meant. The instrument made for writing never was used, being found totally useless; it was cut up by me, and part of the material used by me for making new improvements. The recording instrument had also to be altered."

On page 433 of Avery's testimony is the following: "About the first of April, 1844, we commenced to put up the wires on poles. We erected two wires from Washington to Bladensburg, a distance of eight miles."

Avery states that the instrument for breaking and closing the circuit of the wires was rude, consisting of a slip of sheet copper with one end fastened to the table, while the other being loose moved like a spring which was moved with the fingers to break and close the circuit.

He also testifies as follows: "I invented and made a finger key with a spring and fulcrum for breaking and closing the circuit of conductors, the construction of which was my invention; the finger knob was made of ivory or pearl for insulating the key to prevent the electric shock."

The valuable work of Prof. Henry in the development of his electromagnetic signaling apparatus in 1832 is too well known to need description here; whatever were the latent possibilities of his system at the time, so far as a practical electric telegraph is concerned, they remained undeveloped.

The conclusion seems irresistible that the idea of employing electromagnetism as a means of transmitting intelligence was original with Morse, even though the same idea may have occurred to others at an earlier date, and that he sought out and employed every device applicable to the subject of which he had any knowledge to accomplish the purpose, for which he industriously labored amidst almost overwhelming discouragements for 12 years, before he actually was rewarded with realization of his cherished purpose. Prof. Morse had developed a perfect recording telegraph system before Alfred Vail's attention had been directed to the subject, and of this system, Tal. P. Shaffner, in his "Telegraph Manual," published in 1859, says: "The writing upon the paper with the pencil or fountain pen was rapid and intelligible, and practically effective, though far less so than the modern organizations of the alphabet." (See page 409, "The Telegraph Manual.")

There is no evidence that Morse made a false claim to the dot-and-dash alphabet embraced in his patent of 1840, which was prepared under Morse's personal supervision in Washington during the last days of March, 1838, subscribing to the specification on April 7 following. Vail declares publicly in his book that Morse did invent it. It may be true that Vail suggested some modifications, and had visited the printing office in Morristown as recounted in Mr. Pope's article in the *Century Magazine*.

It is shown in Mr. Vail's book that Mr. Vail was busily engaged in doing two things during the six months after he first saw Morse's telegraph, viz., reconstructing Morse's system in which Morse was taking a lively personal interest, also in constructing on his own account a complicated printing system which he acknowledges worked too slowly to compete with the plan of Morse.

That great credit is due to Prof. Henry for his extensive and original researches in connection with electricity and magnetism; to Alfred Vail for his ingenuity and mechanical skill in the application of the various elements essential to a working telegraph; to Prof. Leonard D. Gale for his assistance in the application of batteries; to Thomas C. Avery for the principle of the present form of transmitting key; and to many others for valuable modifications and improvements, there can be no doubt.

They are honored names each and every one, and should live long in our grateful memories, but there seems no good reason after half a century has gone by to question the right of Prof. Morse to the title of "Father of the Telegraph."

National Characteristics.

Some time ago an American technical journal * gave a humorous explanation of the word "Strassenbahnwagenuntergestelle," which corresponds to the English word "truck." These two words are in a certain sense characteristic of the two languages; a German combines words with each other and obtains a word, which though long, can be understood by one who has never heard it before; the Englishman creates new words for new things or he uses well-known words with a new meaning.—*Elektrotechnische Zeitschrift.*

* See ELECTRICAL WORLD, April 13, p. 451.

Electrodynamic Machinery.—XLII.

BY EDWIN J. HOUSTON AND A. E. KENNELY.

288. The torque produced by multipolar continuous-current motors is independent of the number of poles, if the armature winding be of the multiple-connected type, *i. e.*, if there are as many complete circuits through the armature as there are poles in the field. In every such case, if Φ be the useful flux in webers passing from one pole into the armature, i the total current strength delivered to the armature in amperes, and w the number of armature conductors counted once completely around its surface, the torque will be,

$$\frac{i \Phi w}{20 \pi} \text{ centimetre-dynes, or}$$

$$\frac{i \Phi w}{20 \pi \times 13{,}550{,}000} \text{ pounds-feet.}$$

If, however, the armature be series-connected, so that there are only two circuits through it, and there are p, poles in the field frame, the torque will be

$$\frac{p}{2} \cdot \frac{i \Phi w}{20 \pi \times 13{,}550{,}000} \text{ pounds-feet.}$$

289. In a smooth-cored armature, the electrodynamic force and, therefore, the torque, is exerted upon the active conductors, that is to say, the force which rotates the armature acts on the conductors which draw the armature around with them. Consequently, a necessity exists in this type of motor to securely attach the wires to the surface of the core in order to prevent mechanical displacement.

290. In a tooth-cored armature, where the wires are so deeply embedded in the surface of the core as to be practically surrounded by iron, the electrodynamic force or torque is exerted on the mass of the iron itself, and not on the wire. That is to say, the armature current magnetizes the core, and the magnetized core is then acted upon by the field flux. As soon as the iron of the armature core becomes nearly saturated by the flux passing through it, the electrodynamic force will be exerted in a greater degree upon the embedded conductors, but under ordinary conditions, the electrodynamic force which they receive is comparatively small. A tooth-cored armature, therefore, not only serves to protect its conductors from injury, since they are embedded in its mass, but also prevents their receiving severe electrodynamic stresses. It is not surprising, therefore, that the tendency of modern electrical engineering is almost entirely in the direction of tooth-cored armatures.

291. It might be supposed that the preceding rule for calculating the value of the torque in a motor, whether running or at rest, would only hold true where there existed a fairly uniform distribution of the field flux, such as would be the case where there was no marked armature reaction. Observations appear to show, however, that if we take into consideration the actual resultant useful flux which enters the armature from any pole, the torque will always be correctly given by the preceding rule, even when the armature reaction is very marked.

292. We have hitherto studied the fundamental rules for calculating the torque in the case of any continuous-current motor, whether bipolar or multipolar. It is well to observe that in practice the torque available from a motor at full load can be determined without reference to either the amount of useful flux passing through the armature, or to the amount of full load current strength. For, if a full load output of a motor be P watts, and the speed at which it runs be n revolutions per second, then the work done per second will be $10{,}000{,}000\ P$ ergs. The angular velocity of the shaft will be two $\pi\ n$ radians, and the torque, will, therefore be,

$$\tau = \frac{10{,}000{,}000}{2 \pi n} P \text{ dyne-centimetres.}$$

$$\tau = \frac{10{,}000{,}000}{13{,}550{,}000} \frac{P}{2 \pi n} \text{ pounds-feet.}$$

$$\tau = 0.1174 \frac{P}{n} \text{ pounds-feet.}$$

For example, if a motor gives six horse-power output at full load, and makes 600 revolutions per minute, required, its torque.

Here the output in watts $= 447.6$ watts $= P$, the speed in revolutions per second $n = 10$, $\frac{P}{n} = 447.6$, and the torque exerted by the motor at full load will be,

$$\tau = 0.1174 \times 447.6 = 52.55 \text{ pounds-feet.}$$

If the amount of torque which the motor has to exert in order to start the load connected with it never exceeds the torque when running at full load, then the current which will be required to pass

through the armature in order to start it will not exceed the full load current.

293. Considering the case of a motor armature in rotation, the speed of its rotation for a given E. M. F. applied to its armature terminals will depend upon three things:

(1) The load imposed upon the armature, or the torque it has to exert.

(2) The electrical resistance of the armature in ohms.

(3) Its *dynamo-power*, *i. e.*, its power of producing counter E. M. F., or the number of volts it will produce per revolution per second.

If E be the E. M. F. in volts applied to the armature terminals, τ, the torque, which the motor has to exert, including the torque of frictions in megadyne-decimetres (dyne-cms $\times 10^{-7}$), r, the resistance of the motor armature in ohms, and e, the C. E. M. F. produced in volts per revolution per second of the armature,

Then $n\,e$ will be the total C. E. M. F.

$\frac{E - n\,e}{r}$ will be the current strength received by the armature according to Ohm's law. The activity of this current expended upon the C. E. M. F. will be their product, or $n\,e \times \frac{E - n\,e}{r}$ watts, and this must be equal to the total rate of working, or $2\,\pi\,n\,\tau$, = consequently, $n\,e\left(\frac{E - n\,e}{r}\right) = 2\,\pi\,n\,\tau$ and $n =$

$\frac{E}{e} - 2\,\pi\,\frac{r\,\tau}{e^2}$ revolutions per second.

For example, if a motor armature, whose resistance is 2 ohms, has a properly excited field, which may be either of the bipolar or multipolar type, and is supplied with 500 volts at its terminals; and if the C. E. M. F. it produces by revolution in the field is 40 volts per revolution per second, then the speed at which the motor will rotate when exerting a torque, including all frictions, of 100 pounds-feet (100 × 13,550,000 dyne-centimetres, = 135.5 megadyne-decimetres) will be

$$n = \frac{500}{40} - \frac{2\,\pi \times 2 \times 135.5}{1600} = 12.5 - 1.06 = 11.44 \text{ revs. per second.}$$

294. It will be observed from the above formula that if either the torque be zero, or the resistance of the armature is zero, the speed of the motor will simply be $\frac{E}{e}$ revolutions per second. Or, in other words, that the armature will run at such a speed that its C. E. M. F. shall just equal the E. M. F. applied to the armature, *i. e.*, without drop of pressure in the armature. If the torque could be made zero, the motor would do no work and would require no current to be supplied to it, so that no matter what the resistance of the armature might be, the drop in the armature would be zero. All motors necessarily have to exert some torque in order to overcome various frictions, but on light load their speed approximates to the value $\frac{E}{e}$ revolutions per second. If the resistance of the motor is very small, which is approximately true in the case of a large motor, the second term $\frac{2\,\pi\,r\,\tau}{e^2}$, in the formula, becomes small, and the diminution in speed due to load is, therefore, also small. In other words, the drop which takes place in the armature due to its resistance is correspondingly reduced, permitting the motor to maintain its speed and counter E. M. F. of rotation. Fig. 203 represents diagrammatically a motor armature revolving in a suitably excited magnetic field, and supplied from a pair of mains, *M*, *M*, with a steady pressure of 500 volts. The resistance of the armature is represented as being collected in the coil δ, while the C. E. M. F. of the motor is indicated as opposing the passage of the current from the mains.

The drop in the resistance is represented as being 40 volts, while the C. E. M. F. is 500—40 or 460 volts.

295. The E. M. F. applied to the terminals of a motor armature, therefore, has to be met by an equal and opposite or counter E. M. F. in the armature, which is composed of two parts, that due to rotation in the magnetic flux, or to dynamo electric action, and that apparent counter E. M. F. which is entirely due to drop of pressure in the resistance of the armature, considered as an equivalent length of wire. The activity expended against the C. E. M. F. of rotation is activity expended in producing torque, and, therefore, almost all available for producing useful work, while the activity expended against the C. E. M. F. of drop is entirely expended in heating the wire. As the load on the motor is increased, the current which must be supplied to the motor to overcome the additional torque increases the drop in the armature, and, therefore, diminishes the C. E. M. F. which has to be made up by rotation, and the speed falls or tends to fall in proportion.

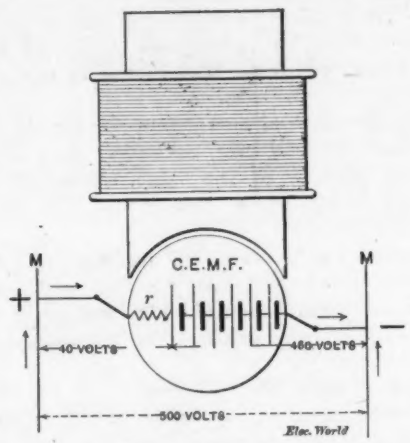


FIG. 203.—DIAGRAM REPRESENTING RESISTANCE AND COUNTER E. M. F. IN A REVOLVING MOTOR-ARMATURE.

296. When a motor armature is at rest, its C. E. M. F. of rotation is zero, and the C. E. M. F. which it can produce under these conditions must be entirely composed of drop of pressure. In other words, the current which will pass through it is limited entirely by the ohmic resistance of the circuit.

If i be the current strength in amperes supplied to a motor armature at a pressure of E volts, the activity expended in the armature will be $E\,i$ watts. The activity expended in producing torque will be $n\,e\,i$ watts, so that disregarding mechanical and electromagnetic frictions, the efficiency of the motor will be $\frac{n\,e\,i}{E\,i} = \frac{n\,e}{E}$, or simply the ratio of the C. E. M. F. of rotation to the impressed E. M. F. This is a maximum at no load; *i. e.*, when the motor does no work, and is zero when the motor is at rest.

The value of e, the volts per revolution per second, is in all cases of multiple connected armatures equal to $\Phi\,\omega \times 10^{-8}$, where Φ is the number of webers of flux passing usefully into the armature from any one pole, and ω is the number of turns of conductor counted once around its periphery.

297. The speed of a motor, therefore, varies to the first approximation inversely as the useful magnetic flux, and also inversely as the number of armature conductors. A slow speed motor, other things being equal, is a motor of large flux or large number of turns, or of both, and, as will afterward be shown, in order to decrease the speed at which the motor is running, it is only necessary to increase by any suitable means the useful flux passing through its armature.

298. Just as in the case of a generator armature whose maximum output is obtained when the drop in its armature is equal to half its terminal E. M. F. (Sec. 9,) so in the case of the motor, the output is a maximum (neglecting frictions) when the drop in the armature is half the E. M. F. applied at the armature terminals, or in symbols when $ne = \frac{E}{2}$. The speed of the motor being then half its theoretical maximum speed, assuming no friction.

Similarly, just as it is impracticable to operate a generator of any size at its maximum theoretical output, since the activity expended within it would be so great as probably to destroy it, being equal to its external activity, so no motor of any size can be operated so as to give the maximum theoretical output of work, since the activity expended in heating the machine, being equal to its output, would probably cause its destruction.

(To be continued.)

Laboratory of Houston and Kennelly, Philadelphia.

Making Haste Rapidly.

The *Chicago Tribune*, in remarking that the last horse car in Philadelphia has retired from business, makes the following pointed remark: "There was a time when men spoke of Philadelphia as slow, but that was several weeks ago."

DIGEST OF CURRENT TECHNICAL ELECTRICAL LITERATURE BY CARL HERING

COMPILED FROM THE PRINCIPAL FOREIGN AND AMERICAN JOURNALS

Note.—Beginning with the issue of July 6, the following changes in the plan of this department were introduced: greater space than formerly will be devoted to abstracts of the more important articles; the large number of references to articles of less importance, especially to those in inaccessible foreign journals, will be reduced; articles belonging more particularly to the science of pure physics, chemistry, mechanical engineering, medicine, etc., rather than to that of electricity, will no longer be noticed.

Note.—Typewritten copies of any of the articles referred to in the Digest, will be furnished at the rate of 5 cents per 100 words for English matter, and 8 cents per 100 words for matter in foreign languages; translations at the rate of 40 cents per 100 words. Copies of any of the journals may be ordered; address Branch Office, ELECTRICAL WORLD, No. 927 Chestnut Street, Philadelphia, Pa.

DYNAMOS, MOTORS AND TRANSFORMERS.

Alternating-Current Motors.—In a discussion of a Physical Society paper by Mr. Rhodes on armature reaction in single-phase dynamos, which paper is mentioned but not abstracted in the Lond. "Elec. Eng.," July 5, Mr. Blakesley stated that the conclusions of the author, that "either of two alternate-current machines may be driven as a motor by the other irrespective of their relative E. M. Fs." is not invariably correct; the facts are these: the E. M. F. of the motor may exceed that of the other machine to a certain extent but that E. M. F. multiplied by the cosine of the angle of the electric lag must yield a product not geater than the E. M. F. of the generator, a fact which he proved geometrically.

New Type of Alternating-Current Motors.—In "L'Elettricista," July 1, Mr. Arno gives a description of a new motor operating on the principle of electro-dynamic repulsion, discovered by Prof. Elihu Thomson.

New Analytical Theory of Rotary Field Motors.—A new theory is given by Mr. Lori in "L'Elettricista," July 1; the article does not admit of being abstracted; it enables the principal problems connected with the subject of rotary fields to be more easily understood.

Transformer Patent Litigation.—Mr. Merissi in "L'Elettricista," July 1, discusses the questions of priority in transformer patents which were brought out by the recent lawsuit between Zipernowsky and Siemens.

Calculation of a Manchester-Type Shunt Dynamo.—"L'Eclairage Elec.," June 15, contains a long article by Mr. Hanappe in which he explains in detail a method of determining the external characteristics of such a dynamo and the variation of the loss of the flux, and the angle of the lag; the same method is used as the one in the article by the same author mentioned in the Digest, June 29.

LIGHTS AND LIGHTING.

Curious Arc Light Phenomenon.—In "L'Elec.," June 15, Mr. Nodon describes the following phenomenon which he recently observed: An arc lamp was surrounded by a spherical globe one half of which had been converted into a reflector, the arc being at a point slightly above the centre of this sphere; it was noticed that the light periodically went out and after a short time started again and it would repeat this at periods of about one half hour; it was found that the consumption of the carbons was abnormally great and at the bottom of the globe were found oblong-shaped pieces of graphite about 1½ in. long, their number corresponding to the number of times the lamp had been extinguished. The explanation is that owing to the fact that the reflector was hemispherical, a conjugate focus was formed on one of the carbons, about one to two inches below the arc; the heat which was concentrated at this focus caused the carbon to become red hot and to be consumed at that point until it was burnt through; the piece which was burnt off fell to the bottom of the globe after which the carbons again adjusted themselves, but as the arc was now below the centre the conjugated focus was formed above it until another piece was burnt off. The remedy of course is to use parabolic reflectors or if a hemispherical reflector is used the arc should not be placed at its geometrical centre but at its optical centre (at a distance of half a radius from the centre) in order that the rays will not be concentrated in a focus on the carbons.

Mangin and Parabolic Mirrors.—In the Lond. "Elec. Eng.," July 5, Mr. Rey (representing Sauter, Harlé & Co.) replies to the recent communication of Mr. Nerz, which was abstracted in the Digest, July 6. The chief points on which he differs are as follows: at the experiments at Toulon the question was whether parabolic mirrors possessed superiority over the Mangin mirrors and the reply of the committee of experts was unanimously that they were not; he asked whether Mr. Nerz is prepared to deliver parabolic mirrors of 90 cm diameter sufficiently exact to enable parallel rays to cross each other after reflection within a sphere of 1 mm diameter; it appears that anything less than 7 mm for the diameter of such a sphere, was objected to by the Schuckert Company in a recent specification; regarding the mechanical strength he states that the Mangin mirror offers the most even resistance to strains applied, whereas the parabolic mirrors must be most rigidly mounted in order to be kept from being deformed and this must cause dangerous stresses due to subsequent overheating; his firm have delivered over 3,000 Mangin mirrors and none of them, so far as they know, have been broken by overheating or by the concussion due to neighboring guns; nor were they injured from intermediate causes as was the case with 50 per cent. of the parabolic mirrors recently installed in a fortress; the actual absorption does not reach one third the amount formerly given, but the difference is of no importance as the efficiency of the whole mirror would vary only 2 per cent. whichever coefficient is taken; he found that the losses of flux are about the same for both types of reflectors.

Cored vs. Solid Carbons.—The "Elec. Jour." (Chicago), July 1, contains an article by Mr. White in which he states that he has found from experiment that the same light will be given from cored carbons with 10 per cent. less watts than from ordinary solid carbons and that therefore 55 lights may be operated from a 50-light dynamo, the amount of light and energy being the same; but he goes on to show that notwithstanding this there is more profit in using long life carbons. The operating cost in using cored carbons would not be reduced in the same proportion, as the coal bill is only between 10 and 25 per cent. of the total operating cost, omitting interest charges. He gives a table of figures based on actual tests in commercial work, containing the items of cost which vary with the kind of carbon; these figures are as follows for a nominal 2,000-cp lamp: for good solid carbons the cost of coal per lamp-hour is 0.48 cents, for carbons per lamp-hour 0.17, for labor in trimming per lamp-hour 0.21, total 0.86 cents; for good cored carbons these items are as follows: 0.43, 0.25, 0.21, total 0.89; for good long life carbons, 0.48, 0.17, 0.13, total 0.78 cents. It will therefore be seen that the saving of the energy for cored carbons is more than compensated for by the increased cost of the carbons burned; the difference of 0.11 cents per lamp-hour between the cored and the long-life carbons amounts to $4 40 per year per lamp burning 4,000 hours or $5.40 for all-night lamps; from this difference should be deducted the interest of the investment of the additional 10 per cent. capacity secured by the cored carbons but this need not be considered in existing plants.

POWER AND HEAT.

Electric Furnaces and Their Application to the Transformation of Carbon into Graphite.—In the Digest, June 8, a recent paper by Mr. Street was abstracted briefly; the complete paper, which is quite long, is published in full in the "Bul. Soc. Int. des Elec." for May. The paper contains a large number of illustrated descriptions of various electrical furnaces and a list of the French and English patents for electric furnaces, up to 1894. The last part of the paper refers to his own furnace which is described and illustrated. In this the arc is under the action of a magnetic field which causes it to revolve over the surface of the crucible, which he claims enables one to arrive at the best use of the heat produced and a better distribution of this heat; the arc may be generated on the exterior of the crucible, on the interior or between two electrodes between which the crucible is placed. In the form illustrated, the crucible is surrounded by non-conducting materials, a carbon rod presses on to it from the top and another, forming the other electrode, is opposite the bottom; the electrodes are vertical and the whole apparatus is enclosed in a tube; two solenoids surrounding the whole furnace, the carbons being in the direction of their common axis. In another form two tubes of carbon are used as electrodes, the arc traveling continually around in a circle between the ends, the crucible being placed in the interior of these tubes at the place where the arc is formed; with this one, 25 grammes of platinum was used in several minutes, and reductions of refractory oxids were accomplished; 80 amperes at 110 volts were used. If the crucible is the negative pole, the metal obtained contains larger amounts of carbon, but if it is the positive pole and the operation conducted with precaution the metal is obtained almost free from traces of carbon; an important factor is the nature of the carbons used; the higher the temperature at which they have been baked the better they are, as the conductivity increases with that temperature.

He made numerous experiments with carbon heated to the highest possible temperature and for this purpose his revolving arc furnace is particularly well adapted; he explains how carbon may be changed to graphite with the aid of this furnace; the consumption of electrodes in the furnace is very small; the length of the arc is adjusted through the medium of the current and the E. M. F. as read in suitable meters; the temperature obtained is so high that carbons may be bent into a curve by submitting them to an end pressure. The carbons obtained by the process in which they are converted into graphite, have interesting properties; their electric and heat conductivity is increased from one to four, the resistance to combustion is greatly increased as also that of the action of fused alkalies; the density of the ordinary carbon 1.98 is thereby increased to 2.6; the proportion of carbon transformed into graphite is 85 per cent.; such transformed carbons may be used to advantage as the negative carbons in arc lamps and they are consumed at only half the rate of ordinary carbons; they are particularly well adapted to electrolysis and especially that of the chlorides; in Mr. Greenwood's apparatus for producing chlorine soda the ordinary carbons did not last more than a few days while the graphitic carbons have been running constantly for 15 months without showing any perceptible sign of being worn away in spite of the fact that the currents used varied from 100 to 1,000 amperes per square metre of the anode; their high conductivity and their homogeneity makes them applicable for brushes for dynamos and it has been found that the current which they can stand is twice as great as that of any other brushes; he is experimenting at present to adapt this furnace to the carbonization of filaments for incandescent lamps.

Calorific Value of Refuse.—Some data from a paper by Messrs. McCallum and Naylor, giving the results of some recent tests of a plant at Royton, are given in detail in the Lond. "Elec. Eng.," July 5; the tests were made with raw sewage and effluent only; the results are given in detail; it appears that the calorific value of dried refuse is about one seventh that of good coal; it is 997 thermal units per pound wet; in conclusion they state that if the results show anything at all they show that the idea of burning town refuse at any sort of profit is erroneous; it cannot be imagined that refuse which gives on evaporation anything less than two or three pounds of water per pound of refuse would not pay for carting.

Transmission of Power in Italy.—According to "L'Elettricista," July 1, an electric plant is being constructed near Battaglia for transmitting 300 hp a distance of ten miles.

Electrically Driven Machine Tools.—Well-illustrated descriptions of a number of different machine tools are given in an article by Mr. Brunswick on "Electric Transmission of Power" in "L'Eclairage Elec.," June 15.

Compressed Air vs. Electricity for Long-Distance Transmission.—The "Eng. Mag." for July abstracts a recent pamphlet by Prof. H. Haupt (the engineer of a compressed-air company) in which he compares electricity with compressed air to the disadvantage of the former. He calculates that power from turbines transmitted electrically 20 miles with a line voltage of 5,000 would cost more than twice (!) as much as steam power generated at the place of consumption, and he concludes that the voltage must be increased much beyond 5,000 in order that electrical transmission may not be "beyond the possibility of attainment at any cost commercially justifiable." As to compressed air, he states that ignorance and prejudice (sic) have retarded its use and that by re-heating the compressed air it can be made to yield more in a motor than it takes to compress it, citing a case to prove this. He calculates the cost of transmitting power 20 and 100 miles through 6-inch pipes with an initial pressure of 2,000 pounds per square inch, and concludes that even at 100 miles there would be a slight difference in favor of compressed air over steam power, the prime motors being turbines; 2,500 hp generated at coal mines by refuse coal costing nothing, transmitted 100 miles in pipes would cost $17 per hp per annum including interest, depreciation, etc., and this he states would be nearly $10 less than the cost of steam power generated locally.

Electricity in Mining.—In a short editorial article in the "Eng. & Min. Jour.," July 6 (one of the leading mining journals in the country), it is stated that the application of electricity to coal mining is growing so rapidly that it may be considered a question of a comparatively short time when it will supersede most other forms of power transmission for this purpose; "mining and metallurgical fields must become, indeed have already become, among the most important markets for electrical appliances of all kinds."

Electric Power for Mining.—The "Eng. & Min. Jour.," July 13, states editorially that one of the most interesting features of the Grass Valley, Cal., electric transmission plant which is under construction, is the means thus furnished for operating a large number of mines which have been shut down for some time owing to the excessive cost of power; within a distance of three to nine miles from the power plant are located 63 mining plants requiring over 4,000 hp, more than one quarter of which plants are at present idle and will be largely benefited by this new enterprise.

Test of an Engine and Generator.—An abstract of a thesis published in the "Rose Technic" for June gives the results of a test of a 250-hp Westinghouse compound engine belted directly to a 500-volt Westinghouse generator of equal power. The friction of the engine was found to be 51.27 hp and that of the engine and dynamo together 63.78 hp, that of the dynamo alone being therefore 12.5 hp; the commercial efficiency varied from 61 per cent. at half load to 82.4 per cent. at full load; the governor kept the speed nearly constant under wide variations of load and was said to be very efficient; the station efficiency, that is the ratio of the electrical output to the indicated hp, was 48 per cent. for half load and 73.6 per cent. for full load; the commercial efficiency of the dynamo increased from 80 per cent. on half load to 85 per cent. for a maximum; the electrical efficiency was 93 per cent. on lighter loads, decreasing to 90 per cent. on the heavier ones; during the test from 6:30 a.m. till noon the average indicated hp was 232 and the average electrical output 133 hp, giving an average station efficiency of 58.6 per cent.

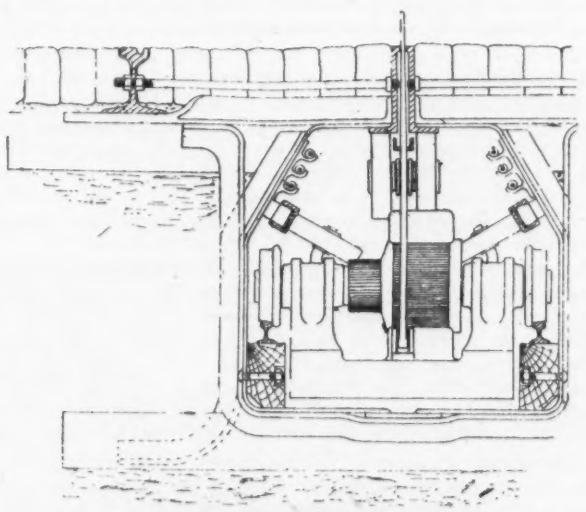
Electric Crane for Railroad Stations.—The one described in the Digest last week is illustrated in the "Elec. Rev.," July 17.

Liquid Electric Forge.—"Elec. Eng.," July 17, contains a short article by Mr. Ker describing and illustrating a horseshoeing establishment at Niagara Falls, in which the well-known system of electric heating by immersing the object in a bath and passing a strong current through it, is used. He gives the following figures: it takes eight seconds to heat a piece of iron ¼ in. square cross-section and one minute for a piece 1 in. square (the length is not given), the latter requiring 26 amperes at 220 volts, which, it is claimed, costs less than a quarter of a cent; the cost of preparing a horseshoe with a coal forge, with coal at $5 per ton, is 5.58 cts., with the electric forge at 15 cts. per kw-hour the cost is 2.32 cts. The solution consists of ten pounds washing soda, 1.5 pounds borax and 45 gallons of water. It is stated that Mr. Burton, who has developed the system in this country, is now applying it to the reduction of metals from their ores and is at present operating a plant in Canada for reducing nickel. (The author incorrectly ascribes the heating to the ignition of the liberated hydrogen gas; the heat generated by the combustion of this small amount of gas cannot even approach in amount that required to heat the metal; the heating is doubtless due to the great resistance offered by the film of gas or in other words there is no doubt a sort of arc formed across the film of gas between the metal and the liquid; it is no more likely that the ignition of this hydrogen generates the heat than that the combustion of the carbons in an arc lamp generate the heat in the arc. Further proofs that the heat cannot be due to the burning of the hydrogen, are that there is no oxygen present under the liquid and that reversing the current will also cause heating, although not as effectively.)

Electric Smelting.—The "Prog. Age," July 1, gives a sort of history of electro-smelting in the form of illustrated descriptions of a number of the earlier electric furnaces, taken from patent specifications.

TRACTION.

Conduit System.—A recent paper by Mr. Cawley is reprinted in full in the Lond. "Elec. Eng.," June 28 and July 5, and in abstract in the Lond. "Elec. Rev.," July 5. The first part is general and of no particular interest; in the last part he describes the Thwaite-Cawley system which consists in general of a large conduit in which the motors themselves run on rails, drawing the car through the medium of a driving bar which passes up through the slot and attached to the car; the arrangement is shown in the adjoining cut; the flat bar passing through the slot is attached to a dummy which draws the passenger car; the



Thwaite-Cawley Conduit System.

dummy is usually carried on three wheels, two on the rails and one with a centre flange running in the slot; this dummy contains the controllers, motorman and brakes, the current being led up through the slot by means of copper strips imbedded in the driving bar; the culvert is 2 ft. 9 in. wide and 2 ft. 6 in. high, being therefore large enough for a man to pass through it; any mud or water in the culvert is swept away by a brush attached to the motor and deposited in wells placed every 300 to 500 feet; the slot is ⅝ in. wide; the conductors are laid in porcelain insulators near the roof of the conduit; the current is conveyed through the medium of a pair of trolley wheels or by sliding contacts; a pair of wheels on the upper part of the motor run against the lower flange of the slot girders and are pressed upward by means of a lever in proportion to the tractive effort required; much smaller driving wheels and therefore gearless motors can be used enabling a higher speed motor and therefore a smaller one to be employed; those shown are 8 in. in diameter. There are two motors having a capacity of 16 hp (presumably both together) which are sufficient for a car having 44 passengers on a fairly level line; the motors are operated by means of the usual controllers. The cost of construction of the conduit complete is given as $48,000 per mile; instead of the dummies, the controllers might be attached to the cars themselves. Among the advantages which he enumerates and which have not already been stated are the following: the tractive power is not affected by snow or frost; ordinary horse-hauled tram cars can be used without any structural alterations; the rails used for horse haulage need not be replaced by others of heavier section; it can be operated in connection with suburban lines using horse or trolley traction. It may also be applied to canal haulage; he estimates that the present cost of horse haulage of canal boats is about three times that in the present system.

Electric Street Railway Statistics in Europe.—The Lond. "Elec. Rev.," July 5, reprints the recent statistics which were published by a German paper; including the lines under construction, the totals in miles for the different countries are as follows: Germany 399.9, France 109, England 84.1, Austria 43.7, Italy 29.3, Switzerland 26.4, Belgium 21.8, Spain 20.5, Russia 8, Servia 6.2, Roumania 5.3, Sweden 4.6, Portugal 1.

Central London Railway.—According to the Lond. "Engineering," July 5, the directors have instructed the engineers, Messrs. Fowler, Baker and Greathead, to proceed at once with the work, the cost of which will be $16,220,000.

Electrical Traction in Milan.—According to "L'Elettricista," July 1, the municipality of Milan is undertaking the substitution of electric for horse-power on the whole network of lines in that city.

High Speed.—According to the Lond. "Elec. Rev.," July 5, Mr. Aspinall recently pointed out the impracticability of very high speed; a train running at 60 miles an hour can be brought to a full stop in 900 feet while one at 90 miles an hour could not be brought to a stop in less than 2,500 feet. No further data from the paper is given.

Problems of Electric Railway Work.—In an abstract of an interview with Mr. Crosby, reprinted from a New Orleans paper in the "Elec. Eng.," July 17, he refers chiefly to railway work. Long distance electric railroading is a mere question of the magnitude of the amount of capital invested; the work to be done cuts almost no figure; that is, electric locomotives can easily be made and have been made to handle the maximum freight or passenger service; the real question is only the frequency of service, and this is important because on it depends the economy with which a central station may be operated; in steam central stations the economy depends on the difference in coal consumption and on the repairs in an electric locomotive as compared with those of a steam locomotive, including also a lower maintenance account of track; the saving must be great enough to pay an increased interest charge because an electric road costs more than a steam road; the results would be in favor of the steam unless the central station can be operated under advantageous conditions; no central power station is worked advantageously if the maximum power is used only a short time each day. He states that no steam railroad service in Southern or Western States could profitably be changed to-day into electric service, but it may also be safely said that the service of the Pennsylvania Railroad between New York and Philadelphia, as that between New York and New Haven and that of the New York Central road as far as Yonkers, could be performed at slightly less cost by electricity than by steam; there is no question as to the desirability of electricity over steam on elevated railroads in large cities. For all classes of service electricity offers an advantage in very high speed; the maximum recorded speed of a steam locomotive with a train is 112 miles per hour made over a few miles of track, the maximum for any electric locomotive is 120 miles per hour made experimentally by him some years ago, but these figures do not give a proper comparison of what can be done; the controlling influence which limits the speed of some locomotives lies in the fact that the boiler is unable to furnish sufficient steam for any considerable run, while the electric locomotive may maintain any speed indefinitely; the dead weight is less for an electric than for a steam locomotive and it can be made to have less atmospheric resistance, which is very important for high speed; for over 100 miles an hour we are driven almost exclusively to the use of electric locomotives; "well-informed experts are agreed that nothing except the inertia of capital now lies between civilization and a transport speed of 150 miles an hour"; it is probable that the earliest line on which such high speed will be adopted will be the one between New York and Philadelphia.

Electric Traction on Steam Roads.—In discussing Dr. Duncan's recent address the "Eng. News," July 11, agrees that when a locomotive is given a full train to haul it can do the work at less cost than an electric motor, but to go to the other extreme it states that the average local passenger train of two to three cars carries 5 to 50 passengers and that a single electric car would do the work of such a train at probably one third the expense for train crew and probably a great reduction in the cost of motive power; the average number of passengers carried in a passenger train in the United States is only 42; as far as the expense of conducting transportation is concerned, the electric motor can therefore compete with the locomotive for passenger traffic over a very wide field; but the branch lines have as a rule too little traffic to pay the interest on the cost of electric equipment and the problem in each case therefore is, will the reduced operating expenses due to the electrical equipment be sufficient to pay a profitable rate on the capital required?

Street Railway Motor Test.—An abstract of a thesis published in the "Rose Technic" for June gives briefly the results of a set of experiments made to compare a number of different motors. A series of tests was made on the road and another by means of brakes (the names of the makers of the motors are unfortunately not given). Taking the average hp required to run a car at full speed, which was found to be 13, and comparing the different efficiencies of the several motors when absorbing this amount of energy, they found a difference of 15 per cent. between the highest and the lowest; the tests were made for a line in Louisville, Ky., on which 175 cars are used during 15 hours; taking 8 hp as an average station load per car, then 15 per cent. of this multiplied by the number of cars gives a difference of 210 electrical hp at the trolley wire, corresponding to 260 at the engine, and this represents what would be saved in case the better motor is used instead of the less efficient one.

Turbine Driven Railway Generators.—The "Elec. Eng.," July 17, and the "West. Elec.," July 20, give an illustrated description of the Ahearn method which is used very successfully at Ottawa, Canada. There is an independently driven water wheel which operates an independent 500-volt dynamo used exclusively for exciting the railway generators, thus removing a multitude of variations of voltage incident to self-exciting water-driven dynamos. The result of the introduction of the separate exciter has greatly exceeded the expectations; besides the self-evident advantages, considerable time is also saved in throwing in dynamos which is now done without delay after the circuit breakers are reset; this formerly required a very considerable time in "synchronizing" the fields.

Circuit Breaker for Electric Railways.—A note in the "Am. Eng." for June states that Mr. Coykendal introduced the following method of indicating the continuance of the short circuiting of the line, in the electric railway power house at Cornell. It is a practice on some roads to replace the circuit breaker at once after it flies out, which may result disastrously; the present device consists in a coil of German silver wire, of seven ohms resistance, which forms a shunt around the circuit breaker and will carry enough current to the line when the circuit breaker is out, to light the cars nearly as well as when the breaker is closed, or move a car away from the position where it is in danger; the electrician merely watches the ampere meter, which rises to 75 amperes, until it drops back to 45, when the breaker will remain in position and it can be put back without danger.

Gas Motor Propulsion.—In an address by President Baxter before the annual meeting of the Western Gas Association, and reprinted in the "Prog. Age," June 1, he refers briefly to the practicability and economy of cars propelled by gas motors which he says has been clearly demonstrated by strict and reliable tests. After enumerating the advantages of such a system over the electric trolley system he gives the results of practical tests made at Dresden; they refer to a five-mile double-track road, with 20 cars, all wires, horses, motors and other equipments included; the cost of construction for the gas motor system is $28,500 per mile, for the electric system $36,200 and for the horse-car system $26,700; the net operating expenses of the three systems are six, eight and ten cents per mile respectively. With the gas motors a speed of 15 miles per hour has been reached; the cars will easily ascend a grade of 1 in 20 and have rounded 38-feet curves. "So much having been accomplished before this method has received an introduction to Yankee ingenuity, we can expect some remarkable results should some enterprising American manufacturers see fit to commence their construction. A model is expected very soon and then our people will be brought to a realization of what it truly is." During the first year of operation at Dessau, Germany, the consumption of gas averaged about 500,000 cu. ft. per car.

Electric Carriage.—The one which was used in Boston is described and illustrated in the "Elec. Eng.," July 17. The storage battery consists of 44 cells with a total capacity of 200 ampere-hours at a normal discharge rate of 25 amperes; the cells are ranged in four groups of 11 cells each, connected to the motor by means of a series-parallel con-

troller; the motor is series wound and has a capacity of 4 hp; the total weight of the carriage is 5,100 pounds; the speed may be varied from 4 to 14 miles per hour.

Trolley Wires for Bicycles.—A brief interview with Mr. Edison on the subject of bicycles, is given in the "Elec Eng.," July 17. He believes it is matter of only a few years before hundreds of miles of bicycle roads will be built with single line trolley wires overhead, especially in the mountains; driving tricycles by storage batteries will undoubtedly be in use in a short time; the batteries are not yet light enough but he believes that one powerful enough to send a bicycle 20 to 25 miles and return on good roads could be made to weigh not more than 60 pounds; a motor weighing 20 pounds would probably be sufficient for a fair speed; he believes that a few years will probably see the system applied to trucking goods in city streets.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Cheap Electricity.—Prof. Forbes in the Lond. "Elec. Eng.," July 5, in referring to the statements regarding the cost of electricity in Germany, which were abstracted in the Digest last week, states that "the price at which the Niagara Falls Power Company supply continuous current to the aluminum works at their required voltage is ½d. (¼ ct.) per kw-hour." According to the "Elek. Zeit.," July 4, the cheapest price, 1.63 cts. per kw-hour, which is charged at the Frankfort (Germany) station, refers only to a very large yearly consumption of at least a million kw-hours, as for instance for a 150-hp motor running during the whole 24 hours of the day; with such a consumption the cost of generating a kw-hour will be reduced greatly and the price was therefore offered as a first step toward cheapening the price for lighting currents.

Gas Engine Central Station in Chicago.—The "West. Elec.," July 20, states that the 400-hp station in Chicago is nearly completed; the largest unit will be a 200-hp tandem engine similar to those used in the Belfast station (a description of which was recently published in The Electrical World).

Brussels.—Some of the illustrations of the description mentioned in the Digest, June 22, are reproduced, with a brief description, in the "West. Elec.," July 20.

WIRES, WIRING AND CONDUITS.

Cables with Air Circulation.—"L'Elec.," June 22, contains an article by Mr. Jaulin in which he describes at some length the lead-covered paper cables with dry air circulation, used by the French telegraph department. According to the specifications, the insulation resistance of each wire measured with at least 100 volts between it and each of the others as well as between it and the lead connected to earth, must not be less than 1,000 megohms per km without temperature correction, and after one minute electrification; the insulation of paper cables diminishes with increased temperature but it is appreciable only for very high temperatures. For obtaining the best insulation it is necessary to continue to force dry air through the cables during the process of manufacture until the temperature has become normal; if this precaution is not taken moist air will be drawn into the cable as it cools; the electrostatic capacity must not exceed 0.07 microfarads per km for 15 seconds of charge; in general the capacities found are below this limit; in a cable of 112 pairs of wires, the difference between the kilometric capacity of a central wire and of one near the lead, can reach 0.02 microfarads. The repairing of paper cables is not easy unless the air circulates freely between the conductors and between them and the lead. The cables are also tested for mutual induction over a length of 1 km by connecting a microphone with one pair and a telephone with another pair, the other ends of both circuits being opened; when words pronounced at a high pitch are spoken before the microphone they ought not to be heard in the telephone connected successively with each pair of wires; if the microphone is replaced by a small induction coil a noise will be heard in the telephone; if one or the other or both circuits are closed the sound will no longer be heard in the telephone. The advantages of the air-circulating cables are given as follows: their low capacity renders them very suitable for long-distance telephony and rapid telegraphy; they cost two or three times less than gutta percha cables; their life ought to be as great as that of the lead surrounding them; making joints requires no particular precautions against humidity as such joints are afterward dried out by the current of air forced through the cable; repairs can very easily be made and if the lead sheathing should be perforated the hole is simply closed with solder and the installation restored by a current of air; such cables are not injured by the action of heat, as gutta percha cables are.

ELECTRO-PHYSICS AND MAGNETISM.

Electrical Properties of Selenium.—A Physical Society paper by Mr. Bidwell is abstracted briefly in the Lond. "Elec. Eng.," July 5. He continued his investigation of the subject and gave the following conclusions: the conductivity of crystalline Se appears to depend principally on the impurities which it contains in the form of metallic selenides; it may be that the selenides conduct electrolytically, and that the influence of light in increasing the conductivity is to be attributed to its property of facilitating the combination of Se with metals in contact with it. A Se cell having platinum electrodes, and made with Se to which about 3 per cent. of cuprous selenide has been added, is, even though unannealed, greatly superior both in conductivity and sensitiveness to a similar cell made with ordinary Se and annealed for several hours. Red Se in contact with copper or brass is quickly darkened by the action of light, owing, it is suggested, to the formation of a selenide. Crystalline Se is porous, and absorbs moisture from the air, and it is this moisture which causes the polarization of Se after the passage of a current. The presence of moisture is not essential to sensitiveness, but appears to be in a slight degree favorable to it. If cuprous selenide is made the cathode in an electrolytic cell and a strip of platinum the anode in water, red Se mixed with detached particles of the selenide is deposited in the water. The photo-electric currents sometimes set up when light falls upon Se are dependent upon the presence of moisture, and are no doubt of voltaic origin. Perfectly dry Se is below platinum in the thermo-electric series.

Prof. Minchin could not agree that chemical action must necessarily follow the action of light in a cell; chemical action due to light may or may not occur according to the nature of the cell. Mr. Appleyard thought that change of contact rather than change of structure was the most promising direction in which to look for an adequate theory of selenium resistance. Prof. Ramsey stated that the quantity of Se liberated in the electrolytic experiment was much too great to be accounted for by the oxygen dissolved in the water; he believes this substance to be on the borderland between bodies which conduct metallically and those which conduct electrolytically.

Loss of Energy in the Dielectrics of Condensers.—The "Zeit. fuer Elek.," June 15, contains an article by Mr. Eisler in which he discusses the subject of the loss of energy in dielectrics, with special reference to dielectric hysteresis; he gives a brief review of the researches that have been made in this field and describes in detail some researches which he made; these show that the energy loss in the dielectric of a condenser is not due entirely to the leakage current passing through the dielectric that is, to the conductivity of the dielectric; the hysteresis loss is not due to the usual hysteresis, but to a time hysteresis; he concludes with a formula for the value of the dielectric hysteresis from which the following conclusions are drawn: if condensers of different capacities and having a like dielectric, are connected to the same effective alternating voltage at the same period, the energy consumed per period is proportional to their capacities; if a condenser is connected to different voltages but of the same frequency it will consume per period an amount of energy proportional to the square of the voltage; if a condenser is connected to the same voltage but of different frequency it will consume energy per period, the amount of which depends on the frequency; with an increasing frequency, it first increases, reaches a maximum and then decreases again.

Electromagnetic Effect.—In a Physical Society paper by Mr. Bowden abstracted very briefly in the Lond. "Elec. Eng.," July 5, he describes the following experiments: A long glass tube containing mercury and fitted with a small standpipe to indicate the hydrostatic pressure, is passed between the poles of an electromagnet; on passing a current of about 30 amperes through the mercury in this tube, the standpipe being turned so as to indicate the pressure either perpendicular or parallel to the lines of force of the field of the electromagnet, movements of the mercury in the standpipe take place; when the standpipe is perpendicular to the lines of force of the field, the mercury rises or falls according to the direction of the current; when the standpipe, however, is parallel to the lines of force, the mercury always rises, whatever the direction of the current. Prof. S. P. Thompson in the discussion stated that there appeared to be three unexplained effects—one proportional to the current and the field and reversible, another independent of the direction of the current or of the field, and a third, which only occurred while the current was changing in strength; in addition, there might be a fourth effect, which up to then had not been noticed; the motion of the mercury column in the opposite direction to that of the drag on the conductor carrying the current. An apparent rise in pressure might be due to a decrease in the density of the mercury, due to the heat developed by the current. In his reply the author mentioned that there were large reservoirs at the ends and that therefore no changes of level were appreciable.

Secular Variations of Magnetism.—An abstract of a recent German work of Dr. Bauer is given in the "Am. Jour. of Sc." for June. The main conclusions are as follows, the first of which he believes can be considered as a safely established result: "1. In consequence of the secular variation of geomagnetism the north end of a freely suspended magnetic needle viewed from the centre of suspension of the needle, moves on the whole earth in the direction of the hands of a watch. 2. The secular variation period (if there be such) is different for various portions of the earth or the secular curve is not a single closed curve, but consists of loops. 3. The north end of a free magnetic needle viewed from the centre of suspension of the needle moves clockwise in making an instantaneous circuit of the earth along a parallel of latitude. Or, the north end of a free magnetic needle whose centre of suspension is fixed in space close to the earth's surface will describe a curve as the earth rotates under it which as viewed from the centre of suspension of the needle moves anti-clockwise. 4. The secular variation and the pre-

vailing distribution of geomagnetism appear to be closely related, *i. e.* seem to be subject to similar laws."

ELECTRO-CHEMISTRY AND BATTERIES.

Galvanic Zincing of Iron.—Mr. Richter's article (see Digest, July 6) is concluded in the "Zeit. f. Electrochem.," June 20. After the articles have been freed from grease they are transported by means of tongs, without touching them with the hands, to the pickling bath, consisting of dilute sulphuric acid of 7.5 degrees B.; in this they are tumbled or rolled over each other in rotating drums, some quartz sand and chopped straw being added; in case tubes are to be plated in the inside also, they should have a roller of some sort inserted during the cleaning operation so as to clean the inside; portions that cannot be cleaned by this tumbling process are subjected to a sand blast; when they come from this bath they must be washed as quickly as possible to avoid being covered with a coating of oxide which is very injurious; it is not sufficient to clean them with clean water, as the acid adheres tenaciously, a stream of water under great pressure, preferably mixed with 0.2 per cent. ammonia should be used. The apparatus for plating tubes and large spirals are illustrated and described in detail; in this the articles to be plated are kept continually in motion so that the current is evenly distributed; the anode should be enclosed in linen bags in order to prevent the impurities from getting into the bath. The color of the finished articles is almost white; the zinc consumed is less than that in the hot galvanizing process; small portions which have not been plated properly can afterward be touched up by the Wagner process in which a paint brush saturated with zinc solution is used as the anode, the faulty spots being then painted with this brush, five volts suffice for two baths in series. He believes that there is no longer any doubt that one can cover iron objects with zinc by the electrolytic method as well, cheaper and having a better appearance, than is possible with the hot method.

Accumulator Without Lead.—The "Zeit. f. Electrochem.," June 20, describes briefly the Platner cell. It consists of a zinc and a carbon electrode in a concentrated solution of pure ferricyanide of sodium; on discharging, a pulverized coating of ferrocyanide of zinc will be formed on the zinc electrode and the solution will be reduced to ferrocyanide of sodium (what the E. M. F. is, is not stated); by passing a current through it, the reverse operation takes place; no gas is developed; to prevent the powder from falling off, the plates are secured in a horizonal position.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Apparatus for Measuring Mechanical Phase Difference.—The Deut. "Zeit. f. Elek.," June 15, contains an article by Mr. Wilke in which he describes a simple method for indicating mechanical synchronism and measuring mechanical phase difference. The optical device of Messrs. Bedell and Moler requires that the shafts of the two machines must be brought closely together in line with each other, which in general is either difficult or impossible; the following arrangement overcomes this difficulty: on each of the shafts is fixed a disc made of an insulating material, having a small piece of metal fixed to a point on its circumference and in electrical connection with the shaft; a current from a battery is led to the two shafts; a brush or other suitable contact device is arranged so that a metallic contact is made whenever the brush comes in contact with the small piece of metal; this brush may be moved through any desired angle, which may be read off on a graduated disc; the brushes on the two machines are connected through a telephone; when the two shafts are in synchronism the contacts in each of these two devices which are connected in series, are made simultaneously and the sound will be heard in the telephone; if there is a mechanical phase difference it may be measured by moving one or the other brush until the sound is again heard; the angle through which it has been moved will then give the required phase difference. The device may be used with two machines having a different number of poles; if, for instance, the generator has ten poles and the motor six, a coincidence of the two contacts will occur for every 30 revolutions and with a speed of 6,000 revolutions on the motor there will be 20 impulses per minute, which is sufficient to be heard distinctly in the telephone. (As machines are very apt to be grounded it might be better to put the battery in the telephone circuit and simply connect the two frames of the machine with a wire.)

Meter Trials in Paris.—The Lond. "Elec. Eng.," July 5, publishes a correction of the article, an abstract of which was published in the Digest last week; the number of failures attributed to the Aron meter should be 1.6 per cent. instead of 15 per cent.

Electrical Units.—In giving a brief account of the units which have been adopted in this country, the Lond. "Elec. Rev.," July 5, points out the few differences between them and those adopted in England.

Comparison of Methods of Testing Transformers.—An abstract of a thesis is published in the "Rose Technic" for June; it gives the results of tests of efficiency and open circuit losses of a Westinghouse and a T.-H. transformer as determined by four different methods; no deductions, however, are drawn from the results nor does it appear that any reliable deductions can be made, as the figures vary considerably.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Storage Batteries for Telegraph Work.—In an article by Mr. Barnett in the "West. Elec.," July 20, he gives some interesting comparative figures concerning storage batteries and gravity cells; he gives a list of the Western Union telegraph offices and the number of accumulators which replaced the gravity cells; the total number of gravity cells displaced was 13,007 and the number of secondary batteries which now perform that service is 2,392; the cost of the accumulators was about $6,071.50 as against $7,804.20 for the gravity cells, but the former does not include the auxiliary apparatus for the accumulators nor the battery stands; accumulators require considerably less than one tenth the floor space required by primary batteries. Regarding maintenance, one writer states that the cost of maintenance of a gravity cell per year is $1.10 and another gives it as $1.65, making an average of $1,375; if the charging current for the accumulators can be taken from a lighting plant the cost is insignificant but if taken from street service mains the current equivalent to that furnished by a gravity cell during one year can be bought for 9 cts. to which he adds 2.5 cts. for interest on equivalent accumulator cell and 2.5 cts. for depreciation, making an approximate cost of maintaining accumulators, even under unfavorable conditions, 14 cts. a year as against $1.375 for the gravity cells. In general the current for main line work is 0.04 amperes per relay while for local circuit work it is five to eight times this amount. He shows how the equivalent accumulator cells may be calculated. He believes it is only a matter of time when accumulators will displace gravity cells in locations where a charging current is available.

Setting Type by Sound.—According to the "Elec. Rev.," July 17, a successful experiment was recently made in Louisville to demonstrate the feasibility of taking telegraphic dispatches directly from the wire to a typesetting machine; a giant sounder in a resonator was placed near the operator's ear and the messages were set in type on a linotype machine; a maximum speed of 50 words a minute was attained and kept up; the speed of the fastest telegraphers is seldom more than 50 words per minute while that of the fastest linotype operators is often 7,500 ems; for an average speed of 25 words per minute the average for the linotype is 4,500 ems per hour, showing that the relative speeds are about the same; for associated dispatches this does away with the intermediate services of the typewriter. It is believed that the practicability of the system has been fully demonstrated, but its adaptability is yet to be proved.

Longest Telegraph Circuit in the World.—Mr. Cawley, in the "Elec. Eng.," July 17, describes a combination of circuits which was recently made in Australia including an almost complete circuit along the shore of the whole island, a total distance of 7,246 miles; transmission was carried on at the rate of 11 words per minute, with repeaters at 14 intermediate offices; it is believed by some that this is the longest distance ever spoken over on any land lines.

MISCELLANEOUS.

Graphitic Carbon.—See abstract above on Electric Furnaces, etc.

Electricity in Plant Growing.—The "Pop. Sc. Mo." for July gives a brief abstract of an article by Prof. Bailey from the transactions of the Massachusetts Horticultural Society. Deherain found that the electric light (presumably the arc light) contained rays harmful to vegetation, but the greater part of the injurious rays were modified by a transparent glass. Bailey found that different kinds of plants were differently affected; the influence of the naked light on the productiveness and color of flowers varied with different species and with different colors of the same species, but all flowers within five or six feet of the arc were injured; in general the light hastened blooming and caused the production of larger stems, but the effect was much obscured by the injuries resulting from the unscreened arc; a globe of plain glass will avert the injuries to flowers and foliage, but he is not ready to recommend the arc lamp for growing flowers; lettuce was greatly benefited and filled out its heads much earlier. The injury done to plants was due to the fact that their vital activity was so hastened that the plant could not supply material quickly enough and was forced to death, but by removing it to a proper distance where water can be supplied with sufficient rapidity to meet the demands, the plant will grow more rapidly or at least mature earlier. Little of an exact nature can be said regarding the application of currents to plants directly; a mild electrical discharge will often seriously injure plants, but the application to germinating seeds and ripening fruit sometimes hastens the process; application of the current to the soil gives various results and so far promises little in the way of commercial returns; the general results of the effect of atmospheric electricity are, that it is in some way beneficial to vegetation; Lemstroem suggests that the modifications produced by it are not direct, but follow some change in the atmosphere which is engendered by the current, and this, Bailey thinks is highly probable.

Woodite.—The "Elec. Rev.," July 17, states that this material, which has been used for three years at the Deptford station (London) has proved to be a very good insulator for high-tension currents on dynamos; a tension of 40,000 volts was insufficient to pierce sheets one-eighth inch thick; it is not acted on by oil even at high temperatures.

Destruction of Copper Piping on Vessels.—From the annual report of the Chief of the Bureau of Steam Engineering, it appears that there is

a rapid destruction of copper piping going on in several government vessels; the reasons for the deteriorations have not yet been determined with certainty; it occurs only in steel ships fitted with dynamos and it is thought that it may be caused by electrolytic action; precisely similar pipes made of the same material, in iron vessels having no dynamos, last almost indefinitely.

The Business Situation.

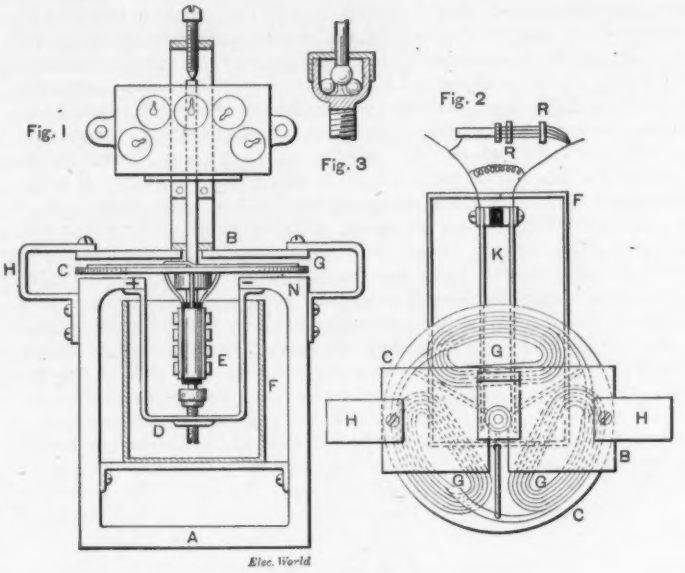
In a recent interview on the business situation, Mr. D. P. Perry, general manager of the Standard Electric Company, Chicago, expressed himself much pleased with the outlook, which he considers was never better for the larger manufacturing companies. The daily reports from his traveling men, local correspondents and customers all comment, he states, on the bright outlook, and the cheerful and healthy tone pervading nearly every line of industry in nearly every community, whether in the West or the South. His correspondents lay especial stress on the plans that are being laid, or for work already contracted for, in the line of improvements and extensions, by individuals and private corporations, as well as public corporations. Mr. Perry does not recall a year in which so many and such large appropriations have been made for all municipal improvements of every character, from electric lighting plants to building, and from street paving to extensions of water plants. Much of this he considers to be due not only to the improved commercial conditions that naturally follow a restoration of confidence, but also to the prospects of abundant crops. And that commercial travelers alone are not optimistic in this respect, he thinks, is clearly shown by the recent action of the president of one of the largest railway systems placing orders for an increase in rolling stock in order the better to be prepared to meet the demand for transportation, not only of grain, but that for which grain will be exchanged.

"Public corporations are feeling the tonic effects of this cheerful condition, and are agitating the question of the lack of economy in longer deferring certain public improvements. Naturally, a certain element in every town having money invested where it brings good returns whether the town rises or falls, are either indifferent or else querulous about the lack of enterprise shown by their neighbors. But the more public-spirited citizen feels that the time has come when his town should put on metropolitan airs simply as an economical investment, for experience has shown that no investment a town can make is quite so productive of immediate returns as improvements that are talked about by traveling men and commented on by ye local editor in the neighboring village. Especially is this true of electric lighting, and many a town has been the recipient of liberal advertising in the editorial columns simply by reason of lighting its streets with electricity. Thus it is quite probable that more than 100 towns now lighting their streets with oil or gas will own an electric lighting plant before the year closes. And these towns can well afford to incur the indebtedness necessary to make these improvements, for if the grain crop should slightly exceed one hundred million bushels in excess of last year, that means an increase in wealth of nearly a dollar per capita for every man, woman and child in the country. And when we consider the values of the other crops, fruits, vegetables, cotton, etc., even on a basis of 50 per cent. of the present outlook, we can readily see that there will be in the neighborhood of $300,000,000 more income this year that will be paid out by the farmer, through the local dealer, than during either of the previous two years."

A New Electric Meter.

A patent on an electric meter, of which we give a description below, was issued to Prof. H. A. Rowland on July 16, one half interest being assigned to Dr. Louis Duncan. Several forms of meters and a number of modifications in details are described, but the principal features are as follows: Referring to Figs. 1 and 2, *A* represents a permanent magnet having enlarged pole-pieces, *N*, to which a soft iron plate, *B*, is secured by means of the brackets *H*. Between the soft iron plate and the pole-pieces revolves a disc, *C*, of copper or other non-magnetic metal, on which are supported three coils, *G*, shown in Fig. 2. These coils consist of copper ribbons wound as indicated, and connections midway between the several coils lead to the commutator *E*, to which current is led by the brushes *K*. The shaft is supported on a ball bearing, such as shown in Fig. 3.

An adjustable resistance, *R*, Fig. 2, is in shunt between the two meter leads, by means of which the meter can be fitted to a given constant. By means of a second adjustable resistance *R*, the meter is automatically regulated for variations in temperature. A case, *F*, surrounds the commutator, and will contain oil or glycerine or any non-conducting fluid, for the purpose of washing away dirt, keeping the contact good and lubricating the commutator to reduce friction.

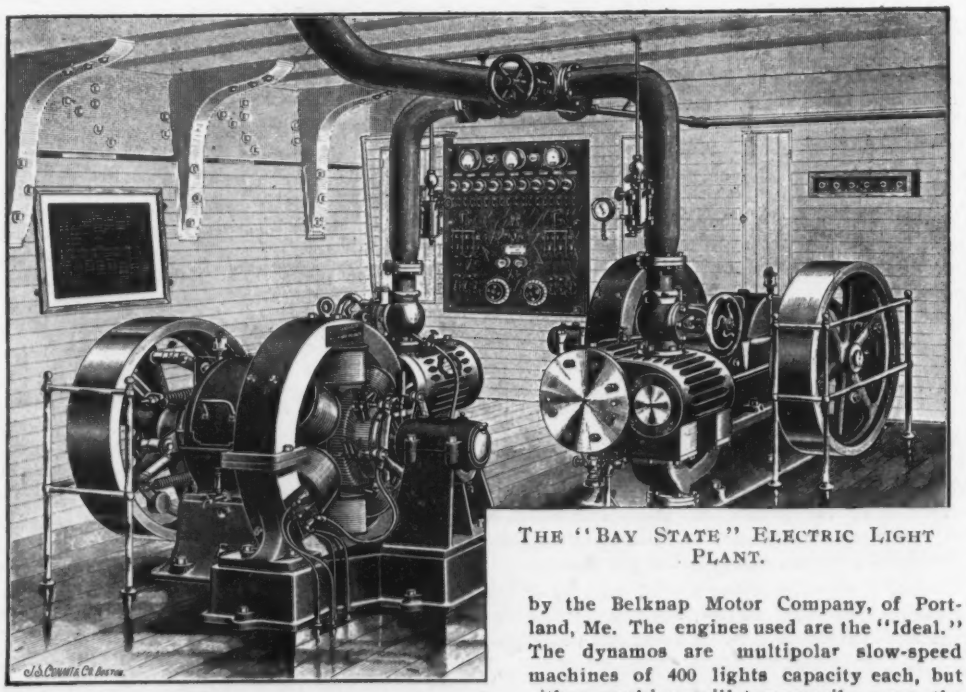


ROWLAND METER.

The object of the meter is said to be to provide a simple and cheap apparatus for measuring the time integral of an electric current, and one of the principal features claimed is the method of supporting the coils of the meter by the same non-magnetic conductor which produces the retarding effect by its revolution in the magnet field. It is stated that this combination of a motor and conductor is not only eminently adapted for measuring the electric current, but it also has a remarkable degree of uniformity of speed, and is suitable for use, for instance, in clocks for driving astronomical telescopes and phonographs, and for a great variety of other purposes, where uniform speed is desirable.

A Marine Installation.

The accompanying illustration shows an electric light plant on the new steamer *Bay State* of the Boston & Portland line, recently installed



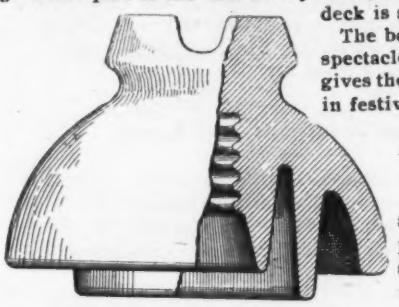
THE "BAY STATE" ELECTRIC LIGHT PLANT.

by the Belknap Motor Company, of Portland, Me. The engines used are the "Ideal." The dynamos are multipolar slow-speed machines of 400 lights capacity each, but either machine will temporarily carry the entire load, amounting to 540 lights. It has become a general practice to use duplicate plants for marine work so in case an accident should happen to either engine or dynamo the duplicate machine can do the work, and it was with this point in view that this plant was designed. The plant reflects much credit upon the Belknap Company, and

has secured for it the installation of two direct-coupled machines on the steamer *Portland*, of the same line, and a similar plant on the *St. Croix*, of the International S. S. Company, which is practically under the same management. These dynamos were designed by Mr. W. H. Chapman, the Belknap Company's electrician.

Eight main feeders controlled at the switchboard in the dynamo room lead to distributing boxes located in different parts of the boat. These distributing boxes have glass fronts and are under lock and key. The fixtures are of the latest design, with opalescent globes and shades, except in the dining saloon, where ground glass globes are used, which give this part of the boat a very cheery and pleasing effect. The freight deck is supplied with guarded fixtures.

The boat at night presents a brilliant spectacle with all its lamps lighted and gives the appearance of a floating palace in festival array.



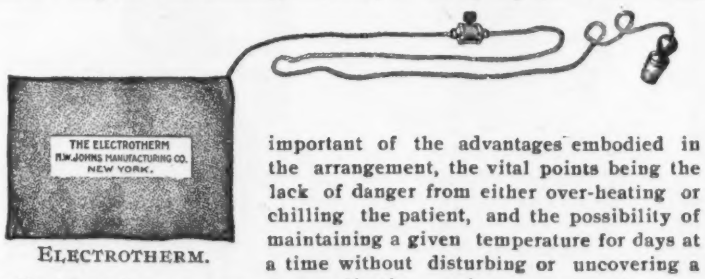
SPECIAL CHINA INSULATOR.

A High Potential Insulator.

The accompanying engraving shows an extra heavy, double petticoat china insulator designed for use on lines carrying unusually high potentials. This insulator is manufactured by Fred. M. Locke, Victor, N. Y., and is made of the very finest grade of china obtainable. It is thoroughly glazed, and the maker claims it will handle a 25,000-volt circuit with absolute satisfaction. The insulator is five and one half inches in diameter at the bottom, and is provided with a groove across the top, in addition to the regulation groove around the body.

The Electrotherm.

The accompanying illustration represents what is one of the most utilitarian heating devices which have so far been constructed. It is manufactured by the H. W. Johns Manufacturing Company, 87 Maiden Lane, New York, and known as the "Electrotherm." The device consists of a flexible sheet of asbestos, in which are embedded high resistance wires, forming an exceedingly convenient heating pad possessing many and salient advantages for use in hospitals, or even sick rooms in private families. The immense superiority, in point of convenience, of the electrotherm, as compared with the hot water bag or bottle heretofore universally used for local application of heat, is so obvious as to require only the statement that the one is designed to substitute the other. Superior convenience, however, is not by any means the most important of the advantages embodied in the arrangement, the vital points being the lack of danger from either over-heating or chilling the patient, and the possibility of maintaining a given temperature for days at a time without disturbing or uncovering a patient in order to renew the application, as is necessarily the case when any other form of heat application is used.



ELECTROTHERM.

The electrotherm, as generally furnished, is 11 by 15 inches in size, one fourth inch thick, and provided with a socket plug, connecting cord and regulating switch. Special shapes and sizes, however, can be made to order.

High-Pressure Packing.

It is but a few years ago that steam at six atmospheres was considered a high pressure, and was about the limit on steam plants. To-day the modern steam plant, with triple expansion or compound engines, 150 pounds is a common pressure, and on many of the larger engines a pressure of 225 pounds is used.

HIGH-PRESSURE PACKING.

The Garlock Packing Company, Palmyra, N. Y., ever alive to the requirements of the times, has produced a high-pressure packing, made of selected fibre and metal in combination with the well-known Garlock packing compound, which has successfully withstood the trials and hardships of stuffing box service on the largest engines for many years.

This packing is especially adapted to high-pressure work on stationary and marine engines. The construction is designed to insure long service. The packing is made in all sizes, from one fourth inch to 2 inches square.

A New Oil Engine.

The accompanying illustrations represent an oil engine which is new to the American market, and possesses several points of novelty and merit. The engine is known as the Hornsby-Akroyd, and is built by Richard Hornsby & Sons, Ltd., of England, who are represented in this country by The De La Vergne Refrigerating Machine Company, East 138th Street, New York. It has the peculiar characteristic of vaporizing the oil within the combustion chamber, and dispensing with any special igniting device, such as a hot tube, electric spark, or flame and slide valve.

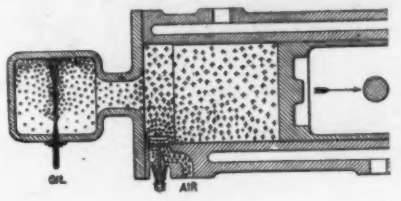


FIG. 1.

Referring to Figs. 1, 2 and 3 it will be seen that the cylinder is provided with an extension communicating with the cylinder by a relatively small neck. This extension is unjacketed and forms a retort in which the oil is vaporized. Nothing but oil in the liquid form is injected into the retort, and only air is drawn into the cylinder. In the engravings the small crosses represent pure air, the circles pure oil, and the squares indicate the product of combustion. The operation is as follows:

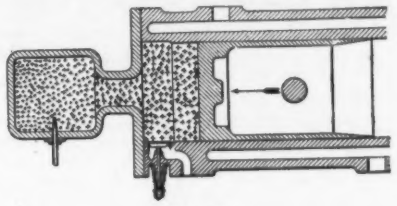


FIG. 2.

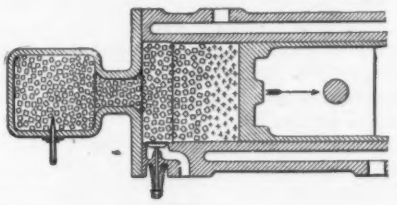
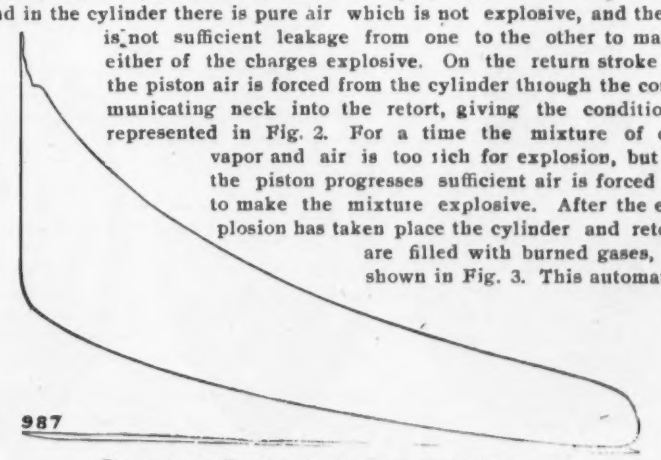


FIG. 3.

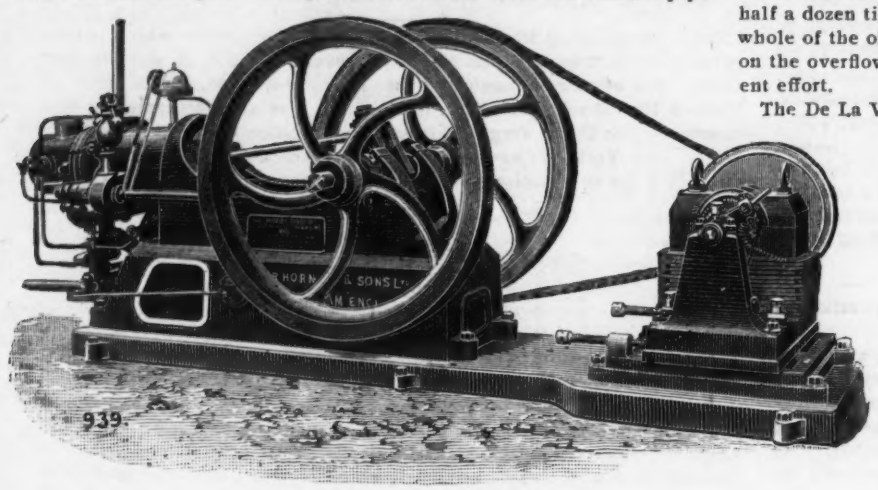
On the outer stroke of the piston, air is drawn into the cylinder and oil is injected into the red hot retort, see Fig. 1. At the end of the stroke, therefore, the retort contains oil vapor, which is not explosive, and in the cylinder there is pure air which is not explosive, and there is not sufficient leakage from one to the other to make either of the charges explosive. On the return stroke of the piston air is forced from the cylinder through the communicating neck into the retort, giving the conditions represented in Fig. 2. For a time the mixture of oil vapor and air is too rich for explosion, but as the piston progresses sufficient air is forced in to make the mixture explosive. After the explosion has taken place the cylinder and retort are filled with burned gases, as shown in Fig. 3. This automatic explosion is found to take place exactly as the piston is making the return stroke, and the results shown in the figures are obtained. It will be noticed that the ignition takes place within the retort, the piston being protected by a layer of pure air. (It is not claimed, of course, that these sketches are *exact* representations of what actually takes place within the cylinder, but their substantial correctness seems to be indicated by the fact that the piston rings do not become clogged with a tarry substance as is usually the case with



INDICATOR DIAGRAM OF 5-HP OIL ENGINE.

his class of engine.) This surplus air should ensure complete combustion, and that this is accomplished is demonstrated by the following analysis by Professor Robinson:

"At the beginning and middle of the trial samples of the escaping gases were taken for analysis. The gases were drawn from the exhaust pipe



Oil Engine Driving Dynamo.

at about three feet from the cylinder, and in each case the gases were allowed to displace the air in the collecting tube for about five minutes

Constituents.	Composition by Volume of Gas.		
	Sample 1, per cent.	Sample 2, per cent.	Average per cent.
Carbonic acid	8.60	8.86	8.73
Carbonic oxide	0.0	0.0	0.0
Olefines and benzine	0.0	0.0	0.0
Hydrogen	0.0	0 0	0.0
Oxygen	9.82	8.86	9.09
Nitrogen	82.08	82.28	82.18
	100.00	100.00	100 00

before the glass tube was sealed by a blow-pipe flame. During this time a considerable amount of steam condensed in each glass tube—the capacity of which was 50 cubic centimeters—and formed about a third of a cubic centimeter of water. The results of the analysis show that the exhaust gases consisted mainly of steam, carbonic acid, oxygen and nitrogen, no traces of carbonic oxide being detected. These products indicate the complete combustion of the oil and an excess of air."

The products of combustion formed consist mainly of steam and carbonic acid diluted with nitrogen and oxygen, so that the exhaust is not in any way objectionable. The oil is sent to the retort by a small pump, which always supplies enough for the full power the engine is expected to develop. If less power is being used the speed increases a trifle and a high-speed Porter governor opens a by-pass and allows the surplus oil to return to the reservoir, which is cast in the base plate.

At The De La Vergne Refrigerating Machine Company's works a Hornsby-Akroyd oil engine is running some wood-working machinery for the pattern shop, and it is interesting to watch the promptness with which the governor adjusts the quantity of oil to the very varying power taken off, which ranges from the full capacity of the engine to nothing half a dozen times within ten minutes. When running light nearly the whole of the oil is seen to run back; the moment a circular saw is put on the overflow ceases and the engine takes the load without any apparent effort.

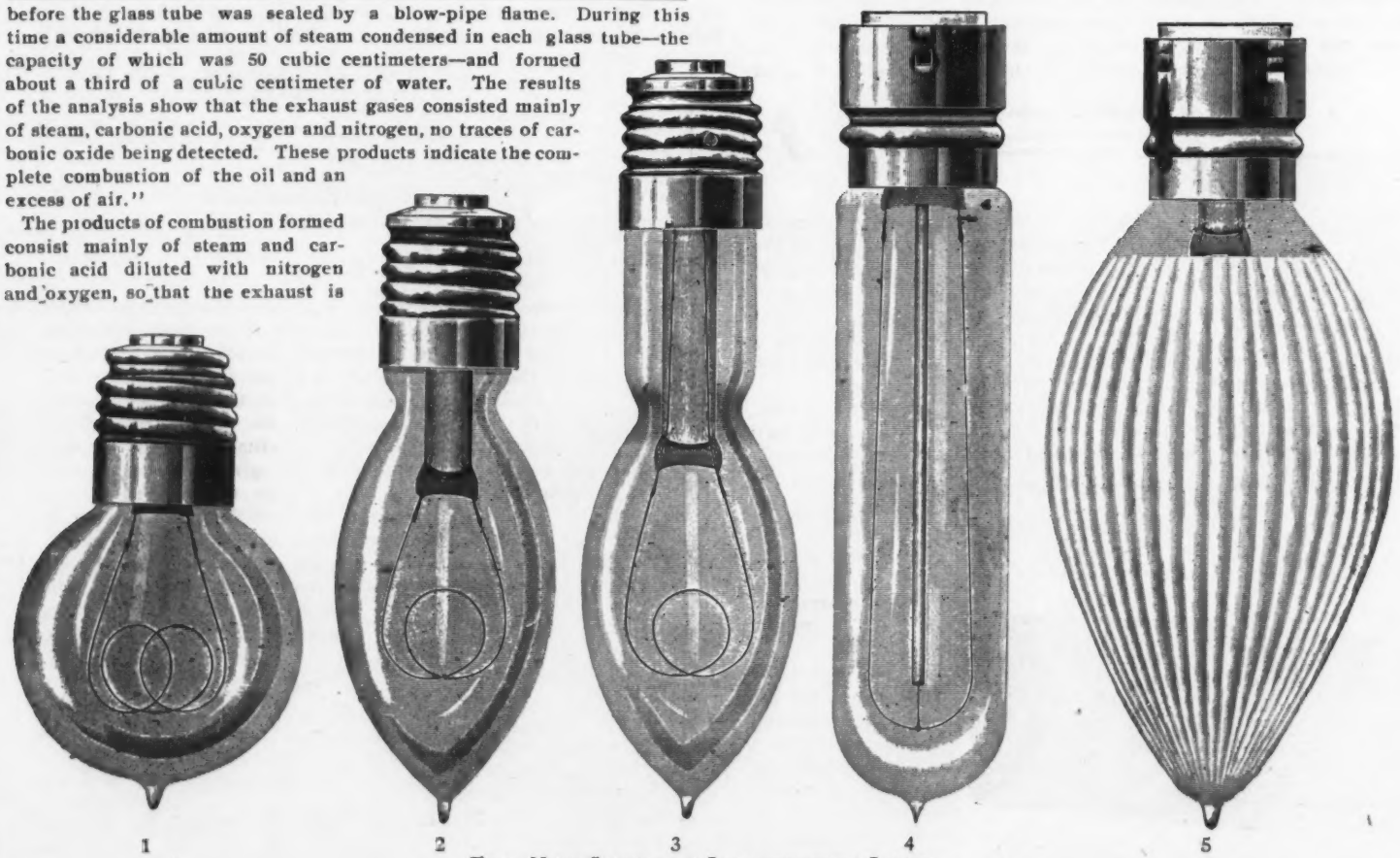
The De La Vergne Company has created an oil engine department under the management of Mr. George Richmond, and expects to have ready for the market at an early date some 20 sizes of these engines. A special testing room will be provided in which all engines will be thoroughly tested prior to sending them out.

New Styles in Incandescent Lamps.

In order to meet the ever-increasing demand for incandescent lamps of special shapes the Buckeye Electric Company, of Cleveland, O., hasbrought out several new types, some of which are shown in the accompanying illustration.

Fig. 1 is known as the "Imperial" type, and has been designed chiefly for decorative purposes, though its compact shape makes it convenient for many uses entirely practical. This type is made for voltages between 48 and 130 volts, with plain, frosted or colored bulb. Extensions of this design are shown in Figs. 2 and 3 which represent what are known respectively as short and long "candle-flame" ornamental lamps. These lamps are made for low voltages, and only in 10-cp size. The bulbs are made of plain, frosted or opal glass. A beautiful effect is obtained by placing a lamp of this type with an opal bulb in the centre of a bunch or basin of white flowers not too closely assembled.

For use in breweries, distilleries, etc., the lamp shown in Fig. 4 is made, its trade name—"Bunghole" type—indicates at once the specific service for which it is intended. This design when furnished with frosted bulb serves admirably as an imitation candle for semi-decorative use, and on electroliers in churches, halls, etc. An entirely novel design is the "Pineapple" lamp shown in Fig. 5, which also is intended only for decorative purposes. The bulb is corrugated vertically, and made either in frosted or plain glass. The softened optical effect caused by the subdivision of the light and the prismatic influence of the corrugations combine to produce a most pleasing result. These lamps are made in all the standard voltages from 48 to 130, and of either 8 or 16 cp.



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Five New Styles of Incandescent Lamps.

NEWS OF THE WEEK

Financial Intelligence.

THE ELECTRICAL STOCK MARKET.

NEW YORK, July 20, 1895.

AMERICAN BELL was fairly steady between 195 and 196 through the week, with comparatively little trading Notwithstanding the recent favorable opinion restoring the status of the Berliner patent, all efforts to keep the stock above 200 have so far failed, probably owing to the fact that, despite the above-mentioned decision, quite considerable competition is being encountered, to eliminate which would require no small degree of expensive litigation.

NEW ENGLAND TELEPHONE.—The stockholders of the Southern New England Telephone Company were surprised on Tuesday to receive a quarterly dividend of $1.50 per share. This dividend is at the rate of 6 per cent. per annum, and is the largest ever paid by the company. For some years the entire income of the company was used in extending operations and perfecting the plant. The highest dividend heretofore has been 5 per cent.

WESTINGHOUSE showed a little more strength toward the latter part of the week. The annual meeting of the company was held on Wednesday, and the old board of directors re-elected. President Westinghouse reported net profits for the year $711,909.68, and a surplus of $3,979,400. An issue of $1,250,000 of 5 per cent. collateral trust bonds was authorized for the purpose of funding a debt of this amount contracted in building and equipping the new works at Brinton, and outlays in connection with the financial plans of the United and Brush Companies of New York and Baltimore, respectively, which are controlled by the Westinghouse Company.

ELECTRICAL STOCKS.

	Par.	Bid.	Asked.
Chicago Edison Company	100	120	125
Edison Electric Ill., New York	100	101¼	101½
" " " Brooklyn	100	..	108
" " " Boston	100	129	130
" " " Philadelphia	100	..	115
Edison Ore Milling	100	13	15
Electric Storage Co., Philadelphia	100	28½	29¼
General Electric	100	36	36¼
General Electric, pref	100	69	71
Westinghouse Consolidated, com.	50	36¼	36¾
" " pref	50	53	54
BONDS.			
Edison Electric Ill., New York	100	105⅛	105⅛
Edison Electric Light of Europe	100	75	85
General Electric Co. deb. 5s	100	..	90¼
TELEGRAPH AND TELEPHONE.			
American Bell Telephone	100	195½	196
American District Telegraph	100	30	40
American Telegraph & Cable	100	94	97
Central & South American Telegraph	100	117	120
Commercial Cables	100	150	..
†Erie Telephone	100	57½	57¾
Gold & Stock Telegraph	100	105	..
New England Telephone	100	..	77
New York & New Jersey Telephone	100	103	105
Postal Telegraph-Cable	100	63½	..
Western Union Telegraph	100	91	91⅛
ELECTRIC TRACTION STOCKS.			
Baltimore Traction	25	20⅝	20⅞
Binghamton RR. com	100	100	..
Brooklyn Traction	100	16½	18
" " pref.	100	..	58
Buffalo St. Ry	100	86	90
Cleveland City Ry	100	68	70
Cleveland Electric Ry	100	59	60
Chicago City Ry	100	305	315
Columbus St. Ry	100	48½	..
Consolidated Traction of N. J	..	26	30
‡Electric Traction, Philadelphia	50	72	72¾
Hestonville	100	59	60
Long Island Traction	100	10	10¼
Louisville St. Ry. com.	100	37	39
" " " pref.	100	87	887
New Orleans Traction	100	24	24½
" " pref.	100	69	71
North Shore Traction	100	34½	37
" " pref.	100	84	88
People's Traction $30 pd	25	61½	61⅞
Philadelphia Traction	50	82½	83¼
Rochester St. Ry	..	38	..
Union Ry. (Huckleberry)	100	112	115
West End, Boston	100	72	72¼
" " pref	100	..	20
Worcester Traction	100	18	20
" " pref	100	86	90
BONDS.			
Buffalo St. Ry. 1st con. 5s	100	106	108
*Binghamton Railroad Co. 5s	100	99	100
*Columbus St. Ry. 1st 5s	100	104	..
Rochester St. Ry. 1st. 5s	100	95	97
*Union Ry. 1st. mtge 6s	100	105	108
*Westchester Electric 1st. mtge. 5s	100	98	101

* With accrued interest.
† Ex-Div.
‡ Ex-rights.

EDISON ILLUMINATING OF BOSTON on Monday declared a 1¼ per cent quarterly dividend payable Aug. 1. This is an increase of 1 per cent. per annum.

BALTIMORE TRACTION continues steady and substantially unchanged. The company's statement, for the quarter ended June 30, shows total earnings of $308,495.34 as compared with $255,488.61, for the same period last year, notwithstanding the unusually unfavorable weather this spring.

PHILADELPHIA TRACTION displayed weakness on Monday and Tuesday because of a report to the effect that an issue of $5 000,000 of 4½ per cent. bonds and similar amount of new stock was contemplated. The report was positively contradicted on Wednesday, and the stock at once rebounded to 81⅜, and continued on to above 82. The annual report filed on Wednesday also had a favorable effect upon the stock. The report shows that after distributing about $1,000,000 for the year ended June 30, 1895, to stockholders, there was a surplus of $1,209.11. Receipts from passengers on the entire system aggregated $5,459,867, against $5 002,111 for the preceding year, an increase of $457,756. There was received from other sources $202 184, an increase of $20,638, making the total net revenue $5,662 051, or $478,394 more than in 1894. Operating expenses including taxes, damages arising from accidents, etc., were $3,364,560.02, rentals and fixed charges $1,296,281.98, making total expenditure $4,660,842. Deducting the latter from the total income a profit of $1,001,209.11 remains, of which, as stated, about $1,000,000 was distributed to stockholders in dividends. Net profits the coming year will necessarily have to be considerably larger to continue the 8 per cent. dividend, as it will require $1,400,000 for dividend purposes for the present fiscal year. The company is now paying dividends on the capitalization of $15,000,000, but in May, 1896, a dividend will be due also on the $5,000,000 new stock authorized last March. Officials of the company are sanguine that no trouble will be experienced in earning more than enough to pay these dividends, as the very favorable showing for last year was made under adverse conditions, which included the operation of the system by three classes of power—cable, horse and electricity—whereas this year its operation will be wholly by electricity, which will reduce operating expenses, and at the same time increases the car mileage.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
253 BROADWAY, NEW YORK, July 22, 1895.

GREAT NECK, L. I., N. Y.—The Village Improvement Society will light Great Neck by electricity.

THE STATE ELECTRIC COMPANY'S TIME EXTENDED.—The committee on gas and electricity has recommended to the Brooklyn Board of Aldermen the extension to Nov. 1, of the time in which the State Electric Light & Power Company shall be expected to begin work in order to retain its franchise.

NEW BRIGHTON, S. I., N. Y.—The New Brighton trustees have granted the Staten Island Electric Company permission to lay tracks in the terminal district, which embraces Jersey Street, the Terrace, the Turnpike and connecting streets; also in Brooks Avenue, and the connecting streets of the Clove Road.

THE OHIO BRASS COMPANY has recently established an eastern office at 1302 Havemeyer Building, with Mr. J. F. Macartney as manager. Mr. Macartney's name is already so familiar in street railway circles that it is almost superfluous to call attention to his achievements in the electrical field. Everyone knows him to be a thoroughly practical man and a competent electrical engineer, as well as a successful salesman.

A FENDER TEST.—The Brooklyn Heights Railway Company has decided to order ten fenders of each of three different designs and put them on the cars at once for a practical test. Among those decided upon is a fender composed of a lattice work of wire which extends from the buffer of the car down to within a few inches of the ground. By an automatic arrangement, when the fender strikes an object it releases a spring which drops a wheel guard into position, rendering it impossible for a person to be caught under the wheels.

FENDERS COMPULSORY.—The failure of the Suburban Traction Company to provide fenders for all its trolley cars running through Bloomfield, N. J., was discussed by the Township Committee last week. A resolution was passed instructing the clerk to notify the company that after July 20 no cars would be allowed to pass through Bloomfield except those provided with fenders. The clerk was also instructed to notify the New York & Greenwood Lake Railway Company that gates must be erected at all grade crossings in the township. Thirty days was given to comply with the law.

INCREASED TAXES.—The Consolidated Traction Company of New Jersey will have to pay taxes to the city of Newark this year considerably in excess of those of previous years. On the reassessment of property in Newark the Consolidated Traction is credited with owning $1,700,000 worth of property and the Rapid Transit Railway Company $300,000. The figures for the Consolidated represents an increase of $200,000, while the Rapid Transit Company operated under the lease by the Consolidated until the present year was not assessed at all. This means that the Consolidated's valuations have been increased by $500,000. It is probable that the tax rate will be reduced, but the reduction will not offset the increase in valuation.

New England Notes.

Branch Office of The Electrical World,
Room 91, Hathaway Building, 620 Atlantic Ave.,
Boston, Mass., July 20, 1895.

THE FITCHBURG MACHINE WORKS, Fitchburg, Mass., reports business as steadily on the increase and prospects generally very bright for the future. Its extensive works are running full time, and with a largely increased force of men, both in the regular and special departments.

MR. W. D. HOFFMAN, New England agent of the Buckeye Engine Company, office 620 Atlantic Avenue, Boston, is still placing engines quite frequently in the New Enigand States. A recent sale is a cross-compound of 200 hp to the Worcester Engineering Company's electric light plant at Milbury, Mass., the construction of which is in the hands of Mr. E. W. Shed, of the Worcester Engineering Company, and Mr. F.N.Snow, mechanical engineer of Providence. This engine will be of special construction, intended for a steam pressure of from 125 to 140 pounds, and will be arranged to run either side independent of the other, both condensing and non-condensing. Mr. Hoffman has placed several large orders in Maine during the month of June and early part of July.

THE BEACON LAMP COMPANY, of Boston, which has so recently succeeded to the business of the Beacon Vacuum Pump & Electrical Company, is rapidly placing itself in first-class position for business. The factory facilities are being considerably increased, and every preparation is being made to meet the demands of the Fall trade. In fact, the new management, with largely increased capital, appears determined to win even greater success. Mr. Edward Cary, so long identified with the old Beacon Company, continues with the new organization as superintendent, and will in addition have charge of the office management. Mr. James T. Haubay, who was also connected with the old company and who has been appointed general manager, will for the present, at least, confine himself particularly to the road.

THE B. F. STURTEVANT COMPANY has sold a strip of the land on which its extensive works at Jamaica Plains are located, to the N. Y., N. H. & H. R. R. Co. and is moving the blower department and machine shop. The shops being crowded with orders for engines and blowers, at this time it is found impractical to suspend work, and those visiting the works are treated to the novel sight of a large three-story brick building traveling off on rollers, while filled with workmen and operating machinery. The traveling blower shop is operated by an electric motor, fed with current from a stationery dynamo, the connecting line being lengthened as necessary. The Sturtevant Company is now furnishing direct-connected engines and dynamos for lighting, and direct-connected blowers and electric motors, thus securing to purchasers the advantages incident to the complete construction of these equipments in one factory and an undivided responsibility for same.

Western Notes.

Branch Office of the Electrical World,
936 Monadnock Building, Chicago,
July 20, 1895.

FOUR-CENT FARES AT MILWAUKEE.—A franchise has been asked for by Chicago capitalists, headed by Congressman McGann, to build an electric line from South Milwaukee through the city to North Milwaukee. The enterprise is backed by ex-Congressman Peter J. Somers and other local capitalists. A four-cent fare is promised.

A TELEPHONE WAR is anticipated at Champaign, Ill. The Phœnix Telephone Company, lately incorporated, since June 15 has been employing 50 men in putting up a new exchange plant which will probably be completed in 30 days. The Central Union Telephone Company evidently does not intend to give up without a struggle, and it is now sending out circulars to its patrons calling attention to the uncertainty of the life of new telephone concerns.

English Notes.

(From Our Own Correspondent.)

London, July 10, 1895.

ELECTRIC FANS.—The large Waverley markets at Edinburgh are to be lighted throughout by electricity, and ventilated by means of an extensive system of electric fans.

CENTRAL LONDON RAILWAY.—The directors of this line have instructed their engineers, Sir John Fowler, Sir Benjamin Baker and Mr. Greathead, to proceed at once with the construction of the line.

DUST DESTRUCTORS AND THERMAL STORAGE.—The Shoreditch vestry has decided to embark in an electric light scheme, which, whatever its financial prospects may be, presents one feature of considerable engineering interest. The vestry proposes to make use of the waste heat of the parish dust destructor for the purpose of assisting in the warming of a battery of boilers, and in addition, proposes to combine this with the system of thermal storage proposed by Mr. Druitt Halpin about a year ago.

THWAITE-CAWLEY SYSTEM OF ELECTRIC TRACTION.—At a recent meeting of the Tramways Institute, a novel system of traction was brought forward by Messrs. Thwaite and Cawley. These gentlemen propose to construct a culvert about 2 ft. 9 in. wide and 2 ft. 6 in. high and to place in it the entire motive apparatus, connection being made through a ⅝-in. slot with the car which is to be propelled by means of a driving bar. The scheme also contains a device for increasing the tractive effort of the motor carriage when required.

ELECTRIC LIGHTING OF THE THAMES EMBANKMENT.—The London County Council, which has been dabbling for two or three years in a scheme for the electric lighting of the Thames embankment and Thames bridges connected therewith, yesterday moved a step further in the matter. In the original estimate, the cost of plant, mains, arc lamp pillars, etc., was over £22 000, the annual cost of running, including interest and sinking fund, being over £3,000. This expensive scheme was not altogether popular, and the result is now a scheme which involves a reduced expenditure and annual outlay, the figures being respectively £16,000 and £2,000.

General News.

New Incorporations.

THE CALIFORNIA ELECTRIC SUPPLY & CONSTRUCTION COMPANY, San Francisco, Cal., is reported as having dissolved.

THE ELECTRIC SHOWER BATH COMPANY, Chicago, Ill., capital stock $30,000, has been incorporated by Levy Beemer, Michael J. Lyons and William A. Cunningham.

THE PONTIAC TRANSIT COMPANY, Pontiac, Ill., has been incorporated by C. C. Strawn, I. F. Funk and L. S. Strawn, to construct a street railway. Capital stock $100,000.

THE COSMELECTRIC COMPANY has been incorporated at Chicago, Ill., by Bassett Cadwallader, Charles O. Barnes and Nathan E. Jamieson, with a capital stock of $7,000,000.

THE ELECTRIC WIRE HANGING INSULATOR COMPANY has been incorporated at Chicago, Ill., by Edgar O. Baker, M. A. Robertson and Henry W. Rice. Capital stock $20,000.

THE WILLAMETTE ELECTRIC LIGHT & POWER COMPANY, Willamette, Ill., has been incorporated by John S. Loyer, John W. Meyer and Edward Webb. Capital stock $15,000.

THE BOONE COUNTY TELEPHONE COMPANY, Boone, Ia., has been incorporated by A. A. During, Charles E. Wells, R. G. Schaaf, J. L. Stevens and W. H. Crooks. Capital stock $10,000.

THE INDIANAPOLIS, ANDERSON & MARION RAILWAY COMPANY, Indianapolis, Ind., has been incorporated by Noah J. Clodfelter and others, with a capital stock of $500,000.

THE MEXIA LIGHTING & POWER COMPANY, Mexia, Tex., capital stock $15,000, has been formed to furnish electric light and power, by John W. Shoaf, W. L. Murphy and W. L. Hall.

THE WEST BROKERAGE COMPANY, San Antonio, Tex., has been incorporated, with a capital stock of $10,000, by J. R. Ransom, J. M. Ryan and Paul Richards, to construct a telegraph line.

THE WADSWORTH ELECTRIC RAILWAY COMPANY, Wadsworth, Ohio, has been incorporated by W. A. Ault, M. C. Lythle, O. B. Dibble, J. S. Oberholtzer, F. C. Lee and F. B. McCauley.

THE SOUTH FREEPORT & CEDARVILLE ELECTRIC RAILWAY, Freeport, Ill., has been incorporated by A. Bergman, Henry Lichtenburger and A. Baumgarthner, with a capital stock of $100,000.

THE KANE STREET RAILWAY COMPANY, Kane, Pa., has been incorporated to build an electric railway. The promoters are C. H. Kemp, Thos. L. Kane and W. P. Weston. Capital stock $6,000.

THE PLAINFIELD ELECTRIC LIGHT & POWER COMPANY has been incorporated at Plainfield, Ill., by Giles G. Foster, A. E. Notinger, U. S. G. Blakely, H. A. Perkins and T. A. Corbin. Capital stock $4,500.

THE SPOKANE TERMINAL RAILWAY COMPANY, Spokane, Wash., capital stock $1,000,000, has been incorporated by A. Openheimer, W. R. Newport A. B. Hopper and H. A. W. Binket, to build and operate a railway.

THE EDWARDS AUTOMATIC CAR FENDER COMPANY, capital stock $100,000, has been incorporated in Brooklyn by P. J. Carlin, Henry W. Rozell, James H. Colyer, John Barnes, M. F. McGoldrick and Charles Edwards.

THE FAIRMOUNT (W.VA.) SUBURBAN RAILWAY COMPANY, capital stock $200,000 has been incorporated by N. A. Clayton, W. T. Horton, C. L. Skinner and others, for the operation of street railways on all the streets in Fairmount.

THE WESTERN ELECTRIC TELEPHONE COMPANY, capital stock $100,000, has been incorporated at Britt, Ia., by J. T. Carr, Charles Webster and T. A. Potter to operate telephone exchanges in Cerro Gordo, Hancock, Kossuth and other counties.

THE LAMPASAS ELECTRIC LIGHT COMPANY, Lampasas, Tex., capital stock $10,000, has been incorporated to furnish light, heat and power, by J. T. Donovan, Sr., E. A. Maxwell, W. L. Donovan, W. H. Browning, J. C. Matthews, Lampasas, Tex.

THE C. E. WOODS COMPANY, Chicago, Ill., capital stock $100,000, has been formed to do general electrical and mechanical engineering and construction work. Among those interested in the project are Charles E. Corrigan, Clinton E. Woods and James R. Corrigan.

THE ECONOMY ELECTRIC LIGHTING COMPANY, Geneva, O., has been incorporated with a capital stock of $12,000, by J. A. Carter, C. H. Munger, Lucien Seymour, C. I. Chamberlain and A. W. Chamberlain, for the purpose of operating an electric lighting plant.

THE GRAUGA CENTRAL RAPID TRANSIT COMPANY, Burton, O., has been formed for the purpose of constructing an electric railway, by P. W. Parmele, George H. Ford, William S. Williams, P. T. Thompson, J. J. Ross and E. M. Yeomans. Capital stock $10,000.

THE DEFIANCE LIGHT & FUEL COMPANY, Defiance, O., has been formed by Walter R. Faben, James W. R. Cline, William Robert Morrison, Oscar T. Martin and John S. Showalter, for the purpose of erecting and operating a gas and electric light plant. Capital stock $30,000.

THE BEACON LAMP COMPANY, Portland, Me., has been incorporated with a capital stock of $500,000 by Chas. Shoninger, Tabian Sachs and Leopold Toosbach, New York, and Isaac Weil, Boston, Mass., for the purpose of manufacturing and dealing in electric and other machines.

THE EASTON POWER COMPANY, Jersey City, N. J., has been incorporated with a capital stock of $100,000 to manufacture and sell electrical machinery and appliances. Among the incorporators are Howard Lacy, Albert B. Carter, Thos. A. H. Hay, William O. Hay, Asa W. Dickinson.

THE NORTH TRUMBULL RAPID TRANSIT COMPANY, Kinsman, O., has been incorporated with a capital stock of $10,000, for the purpose of operating

an electric road. The promoters are James A. Russell, H. L. Perkins, E. M. Yeomans, R. B. Barnes, George E. Haine, R. T. Millikin.

THE LITTLE SAW MILL RUN STREET RAILWAY COMPANY, Pittsburg, Pa., capital stock $36,000, has been incorporated for the purpose of building an electric railway in Pittsburg. The incorporators are M. P. Howley, Pittsburg; Jonathan Barrett, Allegheny, and George W. Lewis, Pittsburg.

THE AMERICAN SYNTHEPHONE COMPANY, Chicago, Ill., has been incorporated to manufacture, buy and sell electrical appliances and all kinds of machinery and products, including invertions and letters-patents, the incorporators being William S. Adams, Asa G. Adams and Louis M. Stone.

THE KLAMATH FALLS LIGHT & WATER COMPANY has been incorporated at Klamath Falls, Ore., with $2,000 capital stock, by Charles S. Moore, George T. Baldwin and H. V. Gates, for the purpose of furnishing electric light and telephone service and a water system for the town of Klamath.

THE ARCADE MUTUAL ELECTRIC LIGHT COMPANY, Cincinnati, O., has been formed for the purpose of manufacturing, selling and furnishing electric light, heat and power. The promoters are Oliver E. Conner, Louis F. E. Hummel, Fred. Seibert, John C. Groene and M. L. Robertson. The capital stock is $15,000.

THE BIG HORN GOLD MINING COMPANY, Los Angeles, Cal., has been incorporated to operate and improve lands, mill sites, mining claims, electric lines, water rights, power plants, etc. The promoters are L. W. Blinn, E. M. Ross, Stephen M. White and F. L. Moore, all of Los Angeles, Cal. Capital stock $2,000,000.

THE CYCLE ELECTRIC LIGHT COMPANY, Chicago, Ill., has been incorporated with a capital stock of $100,000 for the manufacture and sale of electrical, chemical and mechanical appliances, and for buying and selling patents. Among those interested are W. A. Crowdus, John Zimmerman and John D. Thompson.

THE GREENWICH & SCHUYLERVILLE ELECTRIC RAILWAY, of Greenwich, N. Y., has been formed with a capital stock of $200,000, to build and operate an electric railway. Martin Schenck, Troy; Jas. Mealey, Schuylerville; A. M. Crandall, Middle Falls, and Robert Hamilton, Greenwich, N. Y., are the incorporators.

THE METROPOLITAN GAS & ELECTRIC LIGHT COMPANY, San Jose, Cal., has been formed with a capital stock of $500,000 to manufacture, purchase and sell gas, generate and sell electricity, electric light and power and to construct and operate electric railways. The incorporators are J. V. McKiernan, Frank Whitaker, E. C. Randall, W. W. Wood and C. K. Fleming, of San Jose, Cal.

THE YARMOUTH TELEPHONE COMPANY, Yarmouth, Me., capital stock $10,000, has been formed for the purpose of manufacturing and dealing in electrical goods and supplies and constructing and maintaining telephone lines. The promoters are Albert H. Coombs, John Coombs and George E. Coombs, Yarmouth, Me.

PATTERSON HEIGHTS STREET RAILWAY COMPANY, Beaver Falls, Pa., capital stock $6 000, has been incorporated for the purpose of constructing and maintaining an electric railway. Among the promoters are John Reeves, Henry M. Meyers, Harry W. Reeves, James F. Merriman, and John T. Reeves, Beaver Falls, Pa.

THE CAPE MAY COURT HOUSE, LIGHT, HEAT AND POWER COMPANY, Cape May Court House, N. J., capital stock $25,000, has been incorporated for the purpose of manufacturing, generating and dealing in electricity. Among those interested in the project are Alex. R. Springer, Howard Bucknell and Walter W. Hartel.

THE CHICAGO WESTERN ELECTRIC STREET RAILWAY COMPANY, Chicago, Ill., has been formed for the purpose of constructing, equipping, purchasing and operating street railways, to be operated by horse-power, electric power, cable or any other power except steam locomotives. Among those interested in the project are Henry D. Beam, Maier Rosenthal and Harlan W. Cooley. Capital stock $5,000,000.

THE CRANDALL ELECTRIC SIGNAL COMPANY, Jersey City, N. J., and Washington, D. C., has been formed for the purpose of manufacturing and selling electrical devices for the display of signals, monograms, figures, words, designs, etc., by Lucien S. Crandall, Parish, N. Y.; James Curran, Hoboken, N. J.; George B. Fielder, Jersey City, N. J., and Charles F. Manderson, Omaha, Neb. Capital stock $500,000.

THE ALTON RAILWAY & ILLUMINATING COMPANY, Alton, Ill., capital stock $250,000, has been incorporated by Joseph F. Porter, Charles W. Milnor and Henry R. Phinney, to construct and operate street railways by animal, dummy or other motive power; to generate and provide steam, gas and electricity for the purpose of operating street railways and for selling and distributing steam, gas and electricity for light, heat and power.

THE RADNOR ELECTRIC PASSENGER RAILWAY COMPANY, of Radnor, Pa., has been incorporated to operate four and one-half miles of line in Delaware County over the old Lancaster (Conestoga) road, in Radnor township. The capital stock is $30,000. The directors are Henry Douglass Hughes, Andrew J. Reilly, David Pepper, Jr., T. E. Schermerhorn, Frank H. Hawkins, Lincoln L. Eyre, H. A. Mullen, Philadelphia; Albert Layton Register, Ardmore.

THE WEST SHORE RAILWAY COMPANY, San Francisco, Cal., capital stock $2,000,000, has been formed to construct and operate a railway to be operated by steam, electricity or other motive power; to construct and operate telegraph and telephone lines; and to operate steam boats. Among those interested in the project are C. H. Sanger, San Leandra; Behrend Joost, John W. Eisenreith, San Francisco; Louis F. Dunand, San Rafael, and R. S. Thornton, Colma.

THE SACRAMENTO, FAIR OAKS & ORANGE VALE RAILWAY COMPANY, Sacramento, Cal., has been incorporated wth a capital stock of $500,000, for the purpose of constructing, owning and operating a railway from Sacramento to Orange Vale, the road to be operated by steam, electricity, compressed air or any other motive power. Among those interested in the project are L. T. Hatfield, Thomas B. Bell, Frederick Cox, William Schaw and George M. Mott, all of Sacramento, Cal.

ELECTRIC LIGHT AND POWER.

FRIENDSHIP, N. Y.—The village is to have electric lights.

LOCK HAVEN, PA.—The power house at this place will be enlarged.

STEPHENVILLE, TEX.—James Beech will put in an electric light plant.

ADDISON, N. Y.—Addison is to have an incandescent electric lighting system.

PRATTVILLE, ALA.—Prattville is desirous of having an electric light plant.

McGREGOR, IA.—The election on the electric light question has resulted favorably.

SUNAPEE, N. H.—An electric light plant will be established. W. C. Stocker is in charge.

HONESDALE, PA.—The Honesdale electric light plant will be enlarged and improved at an early day.

MT. STERLING, O.—Mt. Sterling has voted in favor of bonding the town for electric lights and water works.

GEORGETOWN, S. C.—W. F. Sudlow, of Florence, S. C., has been granted a franchise for an electric light plant.

ALTOONA, PA.—The Common Council has granted the right to the telephone company to construct its lines in the city.

HOUSTON, TEX.—A new telephone company is organizing; W. N. Shaw, H. M. Fisher and R. B. Morris are the projectors.

MANKATO, MINN.—The proposition to issue $10,000 worth of bonds for an electric light plant was carried at a special election.

BLAIRSTOWN, N. J.—Charles H. Chrisman, of Branchville, has received the contract for putting in the electric light plant here.

MASCOUTAH, ILL.—The City Council has passed an ordinance authorizing an increase of electric street lights, from 75 to 85 lights.

BROOKHAVEN, MISS.—The Brookhaven Manufacturing & Improvement Company has obtained a franchise to erect an electric light plant.

NIAGARA FALLS, N. Y.—At the next meeting of the State Reservation the subject of lighting the reservation by electricity will come up for consideration.

MIFFLINTOWN, PA.—An electric light company has offered to light the town with eight arc lights for $600 per year, and Patterson with six lamps for $450.

SPOKANE, WASH.—The Board of Commissioners of Spokane County has decided that the county will put in a plant for lighting the court house by electricity.

ABERDEEN, MISS.—Proposals will be received until July 25, for supplying an electric light system having a capacity of at least 50 arc and 2,500 incandescent lamps.

BALTIMORE, MD.—The Pennsylvania Railway Company will, it is stated, erect an electric plant to light its tunnels and furnish power for fans to ventilate tunnels, etc.

BOLIVAR, MO.—The city has voted a bond issuance of $8,600 for the erection of an electric light plant and the construction of water works. Address the Mayor for particulars.

ONTANAGON, MICH.—Sealed bids for the construction of a direct-current incandescent electric lighting plant will be received by W. L. Stewart, village recorder, until July 30.

VANLEEK HILL, ONT.—The local electric light plant is being completely overhauled, and will be put in strictly first-class condition under the supervision of Mr. P. E. Marchand.

TRENTON, MO.—Sealed bids will be received until Aug. 1 for lighting the streets of the city from Sept. 15, 1895, to Sept. 15, 1900, by not less than 25 arc lights, each to be at least 1,600 cp.

CHATTANOOGA, TENN.—The Chattanooga Light & Power Company has been awarded the city lighting contract and has decided to erect a new and centrally located plant to cost $50,000.

SHAWANO, WIS.—Sealed proposals will be received at office of City Clerk until August 1, for furnishing electric lights and water works for this city. J. H. Garfield can give further information.

DAYTON, KY.—The Board of Councilmen will receive sealed proposals Aug. 5 for lighting the city with 38 or more electric arc lights, for a term of five years from Oct. 29. C. H. Hayward is city clerk.

CONNEAUT, O.—The Conneaut Electric Lighting Company is in the hands of a receiver and the plant will be sold in the near future. The plant has a capacity of 50 arc and 1,000 incandescent lights. J. Simons is receiver.

PROVIDENCE, R. I.—At a recent meeting of the City Council a resolution was presented suggesting that a committee of three members of the Select Council inquire into the feasibility of the city constructing its own electric light plant.

ANN ARBOR, MICH.—Sealed proposals will be received Aug. 1, for lighting the streets and alleys and public places of this city for a term of five years, beginning Dec. 31, with not less than 96 arc lights of 2,000 cp each and three incandescent lamps of 65 cp each, for 265 nights all night and 100 nights from twilight to 12:30. Glen V. Mills is city clerk.

ESCANABA, MICH.—There is a movement in progress by the authorities to purchase the electric lighting plant, which is now owned by private citizens. The Lighting Company asks $75,000 and the city is willing to pay $70,000. Inasmuch as the city's contract with the company is in all probability illegal, the company will undoubtedly accept the offer.

MICHAWAKA, IND.—Citizens of Michawaka have organized the Citizens' Electric Company, with H. C. Miles, president; M. M. Fisher, vice-president and D. O. Fonda, secretary. The town trustees have closed a contract with the new company for street lights, which are not furnished by the Dodge Electric Light Company, and it is the purpose of the new company to purchase the Dodge plant, if possible.

The Electric Railway.

HOMESTEAD, PA.—The Homestead & Highland Street Railway will extend its line from Homestead to Duquesne.

HOT SPRINGS, ARK.—A company is being formed to build an electric road from Hot Springs to the Cuachita River.

BALTIMORE, MD.—The Baltimore, Columbia & Maryland Railway Company contemplates building two electric power houses.

MIDDLETOWN, CONN.—The directors of the Street Railway Company have voted to construct an extension to Cromwell at once.

SYRACUSE, N. Y.—The City Council has passed ordinances giving the Syracuse Street Railway Company the right to build two extensions.

HILLSBORO, TEX.—It is reported that Boston parties have secured an interest in the Hillsboro Street Railway, and will make it a trolley line.

WATKINS, N. Y.—The Board of Directors of the Watkins & Havana Electric Railway Company have accepted the various franchises granted them.

BIRMINGHAM, ALA.—An effort is being made to have the Birmingham Railway & Electric Company extend its trolley system to North Birmingham.

COHOES, N. Y.—The Cohoes City Railway Company has obtained permission from the State railway commissioners to operate the road with electricity.

MILWAUKEE, WIS.—A company has been formed in Milwaukee for the purpose of constructing an elevated bicycle road from Milwaukee to Chicago.

BALTIMORE, MD.—The City & Suburban Railway Company has decided to extend its Columbia Avenue line to Lansdowne, in the southwestern suburbs.

KNOXVILLE, TENN.—The West Knoxville Street Railway Company will re-lay several of its lines with 56-pound rails, and a power house will be erected.

FAIRMOUNT, W.VA.—Director Hartman, of the Fairmount Railway Company, has stated that the road is to be seven miles long. The trolley system will by used.

CHICAGO, ILL.—The Illinois Central is contemplating the use of electricity instead of steam on its suburban lines between Van Buren Street and Grand Crossing.

PITTSBURG, PA.—Superintendent McCoy, of the Birmingham Street Car Company, has stated that work on the extension of the line will be commenced right away.

KANSAS CITY, MO.—The Kansas City Elevated Railway Company, of which Robert Gilham is manager, proposes to build an elevated viaduct 644 feet long for an electric and cable road.

HAMILTON, O.—It is understood that Peter G. Thompson will shortly begin the erection of an electric belt line, connecting with the Hamilton & Lindenwald Electric Transit Company.

NEW LONDON, CONN.—It is hoped by the street railway company to have a new electric road between New London ready by May 20, 1896. The work of building the road will be begun this fall.

YOUNGSTOWN, O.—The Park & Falls Electric Railway Company has applied to the County Commissioners for franchises for an electric line from the south city limits to Portland and to North Lima.

KANE, PA.—A stock company has been organized and charters secured for the purpose of putting in an electric street car line through the principal streets of Kane and running out to the suburbs.

FORT LEE, N. J.—It has been learned from a reliable source, that the Palisades Railway Company is negotiating with the North Hudson County Railway Company to extend its electric road to Coytesville.

BRIDGEWATER, VA.—B. W. Whitmore and G. W. Berlin are interested in the construction of an electrical line from Basic City to Bridgewater, to connect with the Chesapeake & Western road, now being built.

COCHRANVILLE, PA.—The citizens of Cochranville are unanimous in their opinions that an electric railway from Parksburg to Oxford, via Cochranville and Russellville, would be a good thing for the village.

PITTSBURG, PA.—The people of Liberty and Finleyville are pushing the scheme for the building of an electric line that shall put them in closer touch with Pittsburg. Judge Walker is one of the projectors.

FAIRFIELD, KY.—About $20,000 has been subscribed toward the stock for building the proposed electric road from Louisville to Fairfield. E. H. Bidwell, of Fairfield, and James McKinney, of Louisville, are interested.

TROY, N. Y.—Sealed proposals will be received at Corporation Hall, Green Island, by George A. Van Bergon, chairman, until 8 p. m., July 22, for the construction of a flume, wheelpit and tail race for an electric light station.

RIVERHEAD, L. I., N. Y.—A syndicate of New York & Philadelphia capitalists want to construct and operate a trolley road from Riverhead to Orient, passing through the villages of Riverhead, Jamesport, Franklinville, etc.

FREDERICK, MD.—The question of the construction of an electric railway between Frederick and Middletown is revived. The projectors state that prominent farmers in Middletown Valley have taken their full amount of stock.

ORANGE, N. J.—A company has been formed, known as the Freeman Street Improvement Company, to build a trolley line from the Highland Avenue station of the D., L. & W. R. R. over the mountains to St. Claud. President, John Davis.

ORANGE, N. J.—Watson Whittlesey, receiver for the Suburban Traction Company, will make application to the Common Council at its next meeting for a franchise to extend the suburban tracks from Scotland Street to the West Orange line.

NEW BRITAIN, CONN.—Engineer W. H. Cadwell has been at work for the Central Railway & Electric Company, surveying two routes to Newington from Jubilee Street. The company has a petition in the Common Council for permission to extend its lines to Jubilee Street.

WASHINGTON, D. C.—The residents of Silver Spring, Woodside, Linden and Forest Glen have felt the need of additional rapid transit to Washington. Practical steps toward the building of an electric line to connect with Brightwood Road at North Tacoma were taken by a number of property holders at a recent meeting.

YOUNGSTOWN, O.—Youngstown is desirous of being connected with Pittsburg, Pa., by an electric railway. Since the formation of the company to connect the Beaver Valley with Pittsburg, capitalists of Youngstown have been actively engaged organizing a company to build a road from Youngstown to Beaver Falls.

TRENTON, N. J.—Ex-Senator Miller, of Cape May, has made application to the Court of Chancery for the appointment of a receiver for the Central Traction Company, which is owned and controlled by the New York & Philadelphia Traction Company, and which was organized to build and equip the latter's road.

CHESTER, PA.—Surveys for the new branch of the Delaware County & Philadelphia Electric Railway have been completed and specifications will be ready in a few days for contractors to bid on. The branch will start at Baltimore Avenue and Church Lane, just west of Fernwood Cemetery, and run out Church Lane and Marshall Road to the city line at Cobb's Creek.

KANSAS CITY, MO.—The Northeast Electric Railway has filed a petition with the County Court at Independence for a franchise allowing it to extend its tracks along St. John Avenue from the present terminus at Burge Park 1,600 feet to Budd Park. If this is granted the work of construction will be pushed ahead without delay and the cars will be running to Budd Park in a few weeks.

FRANKLIN, MD.—Residents of the vicinity of Franklin and Wetheredville, Baltimore County, will organize a company to build an electric railway from the latter place to a point on Edmondston Avenue, where it will tap the line of the Maryland & Columbia Railway, now in course of construction. J. H. Judik, president of the People's National Bank, has been named for president of the proposed company.

HACKETTSTOWN, N. J.—It is likely that an electric line will be built between Hackettstown and Asbury, Warren County. The civil engineer of the Lehigh Valley Railway, accompanied by Daniel Osman and Mr. Randolph, has gone over the route to get an estimate of the cost of maintaining bridges in various places. The new system will be a great convenience to the citizens of Asbury and Hackettstown.

BUFFALO, N. Y.—Another new trolley line to Tonawanda is projected to run from the city line at Niagara Street to Tonawanda, and its route will be down the River Road, following the bank around the curve opposite the head of Grand Island to its northern terminal at the New York Central station in Tonawanda. It is understood that the persons interested will immediately take steps to secure a franchise from the city for permission to come within the city limits as far as Hertel Avenue.

ILION, N. Y.—The Little Falls Common Council has granted a franchise to the Little Falls Electric Railway Company to build an electric road in that city. The company proposes to extend the road from Little Falls to Richfield Springs. The Council has also granted a franchise to the Little Falls & Herkimer Company to have an entrance to the city from the west provided satisfactory arrangements can be made to use the tracks of the Little Falls Electric Railway Company, where the two companies occupy the same streets.

MEDIA, PA.—The Westchester Pike Railway Company is prepared to operate its road either by electricity or by steam. The power house of the company at Llanarch is now about completed, and the road will be ready for operation in a few days. It is blocked, however, by two injunctions. One of these enjoins the erection of trolley wires, and the other enjoins the line crossing the tracks of the Pennsylvania Railway at Llanarch at grade. The company has the right to run the road by steam, and it is believed that an agreement can be reached by which the objectors will consent to the erection of the trolley wires.

LOWELL, MASS.—Charles F. Woodward, Daniel G. Walton, and others of Wakefield, have asked the selectmen for a location for an electric road through the town to the Lowell line. The petitioners have subscribed for the stock of a road between Reading and Lowell, by way of Wilmington and Billerica, entering Lowell on the eastern side of the Concord River. The Lowell & Suburban already occupies the road on the west bank of the Concord, with a road to North Billerica, and has a location to Billerica Centre. The new company, it is stated, will ask for a location in Lowell connecting with the Lowell, Lawrence & Haverhill road at Merrimac Square. The stock is subscribed for principally in Wakefield and Reading.

Miscellaneous Notes.

MR. FRED. L. BISHOP, formerly with the General Electric Company, at Atlanta, Ga., has been appointed electrician for the Citizens' Gas & Electric Company, Jacksonville, Fla., vice Mr. Chas. Patterson, who has resigned to take charge of the new municipal plant.

Trade and Industrial Notes.

AN ERROR.—In our last issue it was stated erroneously that Mr. Rogers had withdrawn from the firm of Berger, Rogers & Potter, formerly of Boston, whereas it is Mr. Potter who has withdrawn, leaving the firm Berger & Rogers and not Berger & Potter.

ROBERT ANDERSON, electrical engineer, of Ottawa, Can., reports no lack of business. Besides other contracts recently closed, Mr. Anderson is installing a 600-light incandescent plant at Van Kleek Hill, Ont., and a smaller plant at Hull. Motors of various sizes have been placed with a large number of firms in Ottawa.

THE PARIS HOUSE of the Boudreaux Dynamo Brush Company, of New Yor nd Chicago, received last week a letter from the Director of Material, Frenc Navy Department, advising that "in consequence of the satisfactory results obtained with Boudreaux foliated brushes in the port of Brest," the writer has "authorized the use of them in the five French ports and the establishments of Indre and Guerigny."

THE ELECTRIC APPLIANCE COMPANY, of Chicago, is securing some very pleasing results from the Upton Arc Lamps, and has received a number of flattering testimonials. The direct and alternating-current, constant-potential lamps appear to meet every requirement, and the regular series arc lamp is apparently filling the demand for a first-class lamp at a low price. The company has already placed a number of large orders for all these styles.

A NEW MOTOR-STARTING RHEOSTAT has been brought out by the Hayes-Fyfe Company, of 1006 Pontiac Building, Chicago, the chief feature of which is the use of iron contact plates which are magnetized by the motor current and thus hold the contact roller in any desired position until the flow of current ceases, when the roller is released, the arm returned to the starting point and a double-pole switch opened, automatically cutting the motor entirely off from the supply circuit.

GRAPHITE PIPE-JOINT COMPOUND, 12 or 15 years ago, was known under the name of "smear grease," and later was changed to "pipe-joint grease." It really is not a grease, and as the name has caused some misunderstanding, the manufacturers, Jos. Dixon Crucible Company, Jersey City, have decided to change it to "Dixon's graphite pipe-joint compound." This compound under one or another of its several names, has been in the market for about 20 years. It is not only useful for joints, and all steam, gas and water piping, but is equally useful for smearing gaskets and flange-joints of meters, traps and for bolts, screws, etc. It is infinitely superior, both in usefulness and economy, to red lead, and the Dixon Company recommends it as such with the fullest degree of certainty.

ELEVEN O'CLOCK, P. M., is now the hour at which the factory of J. Grant High & Company, 123 North Third Street, Philadelphia, is closed for the day —or the night, this state of affairs being rendered necessary by the quantities of orders received. One of the firm's leading specialties is switchboard work, and orders for boards have recently been received from the following places: Light & Power Company, Anaconda, Mont.; League Island Navy Yard, Bay View Insane Asylum, Bethlehem Silk Works, Bethlehem, Pa; Joseph Bancroft & Sons, Wilmington, Del.; Grand Hotel, New York; Philadelphia Bourse (four boards); Tokio, Japan; San Francisco, California; Chili and Cuba. Mr. J. Grant High spent a day in New York last week, and as a result took home an order for a very fine switchboard.

PLEASING RESULTS are directly attributable to the new catalogue, No. 3, which the Ohio Brass Company, of Mansfield, O., recently issued. Although it was but lately distributed the results are already plainly felt in the way of increased orders. The Ohio Brass Company finds business in a very satisfactory condition and reports the closing of the following large contracts, besides numerous smaller ones: Benwood & Moundsville Electric Railway Company, Benwood, Va.; Austin Dam & Suburban Railway Company, Austin, Tex.; Cincinnati Street Railway Company, Cincinnati, O.; Brunswick Traction Company, New Brunswick, N. J.; Union Railway Company, New York City; Tonawanda Street Railway Company, North Tonawanda, N. Y.; Lemuel Serrell, contractor, New York City; Ogdensburg Street Railway Company, Ogdensburg, N. Y.; the Mahoning Valley Railway Company, Youngstown, O.; London Street Railway Company, London, Can., and the Interurban Railway Company, Saginaw, Mich.

Business Notices.

ELECTRIC LEAGUE.—Meets every Thursday evening, 100 West 24th Street, New York. Electrical engineers and electricians cordially invited.

BATTERY CUT-OUT CHEAP.—Sensitive, reliable, never requires attention. Gas lighting much improved by its use. Electric Supply Company, of 105 South Warren Street, Syracuse, N. Y.

Illustrated Record of Electrical Patents.

UNITED STATES PATENTS ISSUED JULY 16, 1895.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

542,617. RUNNING GEAR FOR ELECTRIC RAILWAYS; B. J. Arnold, Chicago, Ill. App filed April 13, 1891. The combination of a truck frame spring supported upon wheeled axles, an electric motor carried in a frame thereon, and a gearing between the armature and axle which shares the play of the motor, but permits the axle to play both angularly and eccentrically relatively to the driven member of the gearing.

542,618. TELEPHONE RELAY OR REPEATER; C. H. Arnold, Boston, Mass. Filed March 16, 1895; 542,913, filed March 16, 1895; 542,619, filed March 16, 1895. The combination of two main telephone circuits, two repeating circuits including a variable resistance repeating transmitter and a source of current, and two induction coils having their secondary windings interposed between the ends of the said two main circuits, so that a compound circuit is formed with a secondary winding in each of the conductors, with a bridge between the said two conductors uniting points at the centres of the said two secondary windings, and divided into two parallel branches, and a receiving or repeating magnet in each branch placed in operative relation to the two repeating transmitters, and adapted to control the same.

542,625. CARBON FOR ELECTRIC LAMPS; H. F. Catibau, Paris, France. App. filed April 11, 1895. A compound pencil for electric lamps consisting of a carbon cylinder and a tube of carbon surrounding the said carbon cylinder, and separated by ribs therefrom.

542,638. AUTOMATIC RAILWAY SIGNAL; A. J. Griffin, Wilkesbarre, Pa. App. filed Aug. 7, 1894. The combination of a signal tower having a signal thereon, a guide slot, a set of pivotally supported lazy tongues carrying a pin which works in the said slot with a connection between the tongs and the semaphore, train-controlled operating devices connected with the tongs, and means for locking the pin carried by the tongs to hold the latter extended position and also means for tripping the pin which holds the tongs extended, so as to allow them to fold.

542,640. ELECTRIC GOVERNOR; W. W. Handy, Lake Roland, Md. App. filed May 1, 1895. The combination of a dynamo, a prime motor and mechanism for regulating the force applied to the motor, a shunt coil and a series coil in the same circuit and mechanism operated by the said coils, and a mechanism to control the force applied to the motor.

542,657. TELEPHONE REPEATING CIRCUIT AND APPLIANCE; W. L. Richards, Malden, Mass. Filed March 16, 1895; 542,658, filed March 16, 1895. The combination of two main telephone circuits, each having two alternate germinal branches extending through a relay magnet and the secondary winding of an induction coil, an electromagnetic switch for each circuit controlling the relation of the said circuit to its said two branches, and current changing devices for each circuit controlling the polarized switch of the said circuit.

542,662. ELECTRIC ARC LAMP; E. Thomson and C. E. Hartnan, Swampscott, Mass. App. filed June 25, 1894. The combination of a lamp, an arc-striking mechanism, a feeding mechanism and electromagnetic devices for actuating the two devices, arranged to operate the arc-striking mechanism by its major movements, and to operate by its minor downward movements the feeding mechanism without moving the arc-striking device.

542,663. ELECTRIC MEASURING INSTRUMENT; E. Thomson, Swampscott, Mass. App. filed April 25, 1895. An instrument consisting of a coil or conductor traversed by the current to be measured, placed in an inclined or angular position with respect to the shaft carrying the indicator, and a bar or plate of magnetizable material carried on said shaft also at an angle with said axis, with means for bringing the indicator to zero when no current passes.

542,664. ELECTRIC ANNUNCIATOR; E. Thomson, Swampscott, Mass. The combination of an electromagnet having a core extending nearly to the lower end of the spool, a cylinder having opposite slots, inserted in the lower end of the spool, and a drop of about half the length of the cylinder, as a trigging device in an electric annunciator.

542,667. REGULATION OF CONTINUOUS-CURRENT MOTORS; M. J. Wightman, Scranton, Pa. App. filed April 2, 1895. A method of regulating an electric motor which consists in starting the motor as a two-pole machine by shunting a portion of the motor, and then throwing the parts of the armature winding into multiple and running the motor as a four-pole motor.

542,670. CABLE RAILWAY; W. M. Wood and J. C. Miller, Elmira, N. Y. App. filed May 29, 1894. The combination of a conduit, a grip carried by a car, contact devices located in the conduit, an arm mounted in the wall of the conduit adapted to be disposed between the contact devices and the grip, and a movable device carried by the grip for operating said arm to close an electric circuit through said contact devices.

542,697. BURGLAR ALARM CIRCUIT CLOSER; A. A. Vanderpool, Newark, N. J. App. filed Nov. 8, 1894. The combination of a case having a face plate and a pin at the back thereof, a lever arranged on the said pin and projecting laterally at its opposite ends beyond the opposite edges of said face plate, and at opposite ends carrying rollers, a block of insulation back of the said lever, and holding the same in place and a contact spring fastened to said block and extending into the path of the said lever, the latter scraping the edge of the said spring longitudinally when forced to its abnormal position.

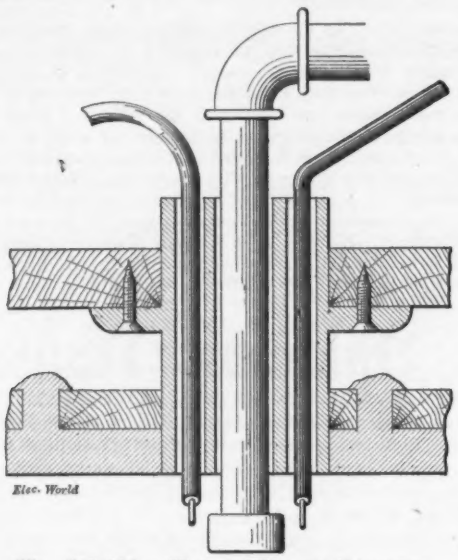
542,699. RAILWAY SIGNAL; F. B. Wetherbee, Walpole, Mass. App. filed May 3, 1895. An electric signal consisting of two oppositely arranged magnets separately in electrical connection with the track, the two armatures thereof, the bell circuit arranged to be closed by the movement of the armatures, the vertical standard arranged between said magnets and the hooked bar pivoted intermediate of its length to said standard, said bar being adapted to be operated to lock either of said armatures.

542,713. FUSE HOLDER; L. C. Orrell, Bellevue, Ky. App. filed Oct 22, 1894 The combination of a piece having a loop and another piece having a part which slides into the said loop, and a contact over the said piece and means for elastically pressing the piece against the said contact.

542,761. ELECTRIC BLOCK-SIGNAL FOR RAILWAYS; A. C. Gordon, Rochester, N. Y. App. filed May 13, 1895. The combination of a shifting signal, a magnet, a rod between the signal and magnet provided with an armature, a motor connected to the rod, whereby the latter is operated, a circuit connected to the motor and provided with a switch, so that when the circuit is closed the motor first draws down the armature, then stops, while the magnet continues to hold the armature in place.

542,769. ELECTRIC SIGNAL APPARATUS; T. B. Keeler, Rahway, N. J. App. filed March 11, 1895. The combination of a semaphore blade, a disc mounted to move therewith, an electromagnet carried by said disc, a part mounted to rock relatively to said disc, swinging catch under the control of the electromagnet to lock the said rocking part to and release it from the disc and signal operating means connected with the said rock part.

542,771. MEANS FOR GENERATING ELECTRICITY FROM CAR OR WHEEL AXLES; M. Moskowitz, Newark, N. J. App. filed Feb. 27, 1895. The combination of a working and lamp circuit containing lamps or other translating devices, main dynamo operated under varying speeds and subject to armature reversal, a pole changer and a dynamo are adapted to equalize the voltage of the dynamo in the main circuit, the dynamo being self-exciting at a slow speed, to energize the pole changer and the dynamotor, and the dynamo at a fast speed having its fields excited and regulated independently by the dynamotor.



No. 542,924.—HOUSE WIRING FIXTURE.

542,772. MAKE-AND-BREAK SWITCH; M. Moskowitz, Newark, N. J. App. filed April 23, 1895. A switch consisting of an electromagnet in shunt circuit and one also in series, a commutator controlled by the shunt magnet to establish a complete circuit through the said series magnet and cut the said shunt magnet out of circuit.

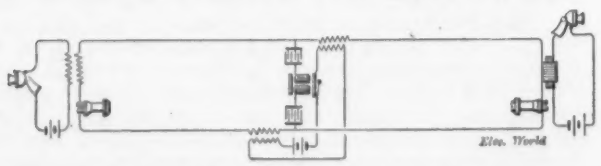
542,773. POLARIZED COMPOUND SWITCH; M. Moskowitz, Newark, N. J. App. filed May 2, 1895. The combination of an electromagnet subject to variable polarity, a pair of electromagnets adapted to be brought in circuit by the action of the said electromagnet of variable polarity, and a pair of commutators controlled by said pair of electromagnets, the said commutators comprising commutator sections which are open-circuited, and other sections which are electrically connected with the armature bars.

542,775. FIRE ALARM; J. R. McCoy, Marshalltown, Ia. App. filed April 3, 1895. The combination of an electrical conductor extending in parallel lines and being disconnected, circuit closers comprising links provided at their extremities with eyes, the eye at one end of each link being swiveled upon the leg of the conductor, continuous combustible heads arranged at intervals and attached at their free ends to the eyes of the free ends of the links, and means for normally straining the free end of the link toward the conductor in opposition to the resistance to the lead, so as to hold them in tension.

542,783. FIRE ALARM DEVICE; J. F. Snapp, Frichton, Ind. App. filed April 13, 1895. The combination of an enclosure comprising a wall having an insulated lining, a contact arranged therein and adapted to be electrically connected with a generator and a signal, a spring arm extending through the enclosure cover with a contact upon the end thereof adapted to be electrically connected with a generator and a signal and means for normally holding the contacts apart.

542,822. MICROPHONE; H. Carbonelle, Brussels, Belgium. App. filed Oct. 9, 1894. A vibrating diaphragm consisting of a vibrating plated casing, a bell mouth and a carbon button connected with the said plate and a filling of carbon granules, the conductors from the carbon button being suspended by an intermediate connection.

542,833. ANNUNCIATOR; J. W. Olson, Chicago, Ill. App. filed Nov. 21, 1894. The combination of a magnet core, a coil therein, a vertical extension being provided upon one end thereof, a bar pivoted near the middle to the upper end of the extension, the said bar being adapted to lie parallel to and close against the coil, and an annunciator drop normally engaged by the opposite end of the bar, that end being of greater weight than the other.



No. 542,618.—TELEPHONIC REPEATER.

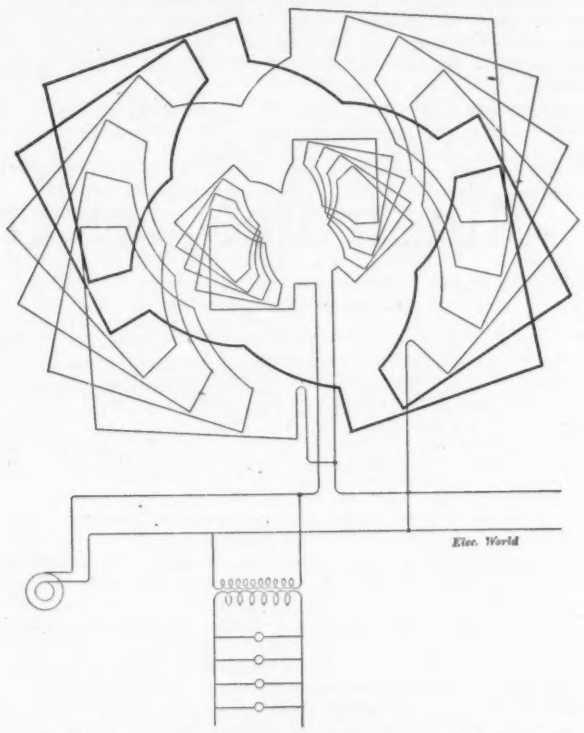
542,848. ELECTRIC SWITCH; G. T. Ryanson, Philadelphia, Pa. App. filed May 10, 1895. The combination of two pairs of circuit terminals, pivoted connecting blades therefor, with an open-yoke bar connecting the same, an intermediate arm extending through the said yoke bar, and a flat spring connected with the arm and engaged with the yoke bar.

542,911. SEPARATING METALS FROM FOREIGN SUBSTANCES; H. H. Whitacre and A. C. Wolfe, Wellsville, O. App. filed Feb. 14, 1895. The combination of a supply pipe, a double branch pipe having electromagnet coils wound therein and faucets at the free ends, a valve in the supply pipe and a pipe for cleansing connected to the supply pipe between the valve and the branch pipe connection.

542,916. ELECTRICAL SYSTEM FOR SIGNALING BETWEEN TRAINS; A. B. Baque, Madrid, Spain. App. filed Jan. 21, 1895. A system comprising conductors in sections, a magneto machine carried by each train, and means to set the same in motion by the movement of the train, contacts also being carried by the train to make contact with the said conductors, telephonic apparatus and signal bells and a switch carried by each train to throw the telephone apparatus or the signal bells to line and connections, so that at the moment of closing the circuit between two trains each one will receive a signal.

542,924. HOUSE WIRING FIXTURE; C. F. Case, Akron, O. App. filed April 20, 1895. A fixture comprising an insulator having a pair of tubes for inclosing electric wires and a laterally projecting attaching plate disposed intermediate of their length, and another tube for the passage of a gas pipe located between the said pair of tubes.

542,926. ELECTRIC ANNUNCIATOR; W. J. Clarke, Trenton, Canada. App. filed Feb. 5, 1895. The combination of drop circuits and a battery, return call circuits and a battery, a bell for each room comprising magnets with a vibrating armature, three binding posts and circuit wires, a relay connected with two of the binding posts and the return call circuits, and having a switch armature controlling the bell ringing circuit through the other two posts by the action of the relay.



No. 542,968.—ALTERNATING-CURRENT REGULATOR.

542,928. SIGNALING APPARATUS; L. S. Crandall, Parish, N. Y. App. filed Feb. 17, 1893. The combination of a display frame having central cross bars and corner extensions and also having a series of incandescent lamps disposed thereon, a keyboard consisting of a series of spring-controlled key bars each having contact points, a contact board with contact bars, a battery, and electrical connections between the battery and the display frame, between the battery and keyboard and between the contact board and display frame.

542,953. ELEMENTS OF GALVANIC BATTERIES; F. A. von Alimonda and N. von Alimonda, Castello Alimonda, near Sagrado, Austria. App. filed Oct. 30, 1894. The combination of a carbon electrode, a retaining plate of the same material, and forming practically part of the electrode, a leading-in wire with its end bent at right angles, it being anchored in the material between the electrode and the retaining plate.

542,959. ELECTRIC GAS LIGHTER; H. G. Grier, Philadelphia, Pa. App filed May 31, 1895. The combination of a burner, a screen, a channeled flange above the screen in which the gas circulates, electric contacts at the channel and means for creating a spark at the contacts.

542,968. REGULATOR FOR ALTERNATING ELECTRIC CIRCUITS; C. P. Steinmetz and A. H. Armstrong, Schenectady, N. Y. App filed Feb. 16, 1895. The combination of a primary having a winding coupled in shunt across the regulated circuit, an induced or secondary member having a corresponding winding in series with one of the circuit mains, and means for adjusting the two members so that the field and armature poles may stand at a desired angle to one another.

542,979. SYSTEM OF ELECTRICAL DISTRIBUTION; G. W. von Siemens Berlin, Germany. App. filed April 26, 1893. The combination of a source of energy, feeder conductors leading therefrom, main distributing conductors, translating devices arranged in parallel series of said conductors, and devices for automatically regulating the potential of the current between a pair of the distributing conductors by the counter E. M. F. of the said regulating devices.